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REVISION OF THE AFRICAN SNAKES OF THE GENERA DROMOPHIS AND PSAMMOPHIS

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Revision of the African Snakes of the Genera Dromophis and Psammophis

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During the past forty-five years, numerous authors have commented on the urgent need for revision of the African members of the genus *Psammophis*. Nevertheless the task has not been undertaken, partly on account of the large number of alleged species to be dealt with, but chiefly because of the formidable extent of the bibliography to be examined.

References to the genus have been found in 470 books and papers cited in this paper and the involved synonymy straightened out to the best of my ability. Even though a quarter of the present contribution is devoted to such synonymy, it appears worth while to publish the result, for it covers nearly half-a-century in which confusion of racial characters has led to the repeated recording of forms and species in regional check lists for areas remote from their true range. Take for example the name *sibilans* which has, at one time or another, been applied to 11 of the 21 species recognized in the two genera. The citations for *sibilans* (*sensu strictu*) alone number over 250. Every reference has been looked up and the resultant data, after careful scrutiny, embodied in this paper, which, in effect, purports to be a digest of our knowledge of each species up to the end of 1939.

All the material in the Field Museum of Natural History and the Museum of Comparative Zoölogy has been studied. The latter collection contains fifteen of the eighteen forms of *Psammophis* recognized. As a result I have been enabled to extend the range of variation and recast the descriptions furnished by the late Dr. G. A. Boulenger in his monumental "Catalogue of the Snakes in the British Museum" (1896d, **3**, pp. 155–171). Unfortunately two of the key characters employed by that author have subsequently proved to be so variable as to possess only a relative value, I refer to the breadth of a rostral in relation to its height, and the width of the frontal in relation to that of a supraocular.

This study has brought to light several interesting facts, chief among which appears to be that members of the genus *Psammophis* which have suffered mutilation of the tail, have the ability to regenerate a terminal point on the truncated tip! When the amputated portion was not very great, or the injury occurred early in life, the loss is not

obvious; indeed many workers, including myself (1929h, p. 32), have assumed, or stated, that tails were intact, which, in reality, were not so. As a result, the range in number of subcaudals has from time to time been augmented by the inclusion of counts from specimens exhibiting a terminal point which, however, may have lost many subcaudals. It transpires that the sum total variation in ventral counts of both sexes of a given species or race, is in a fairly definite ratio to the sum total variation of subcaudals in the same species or race. This will be appreciated best by reference to, and comparison of, columns 1 and 2 of Table II. Where the subcaudal range was greatly in excess of the ventral range, reference to the specimens furnishing the lowest subcaudal counts almost invariably revealed injured tails with regenerated tips. In this way many errors have been eliminated.

It also became obvious that a range of from 20 to 25 appeared normal, but that forms like *schokari* and *sibilans* (*sensu strictu*) which enjoy an extensive distribution, have a much greater range of ventral counts than forms occupying a more restricted area. In the case of *schokari* it seems possible that further division of the form will be recognised as its range is from Mauretania, in West Africa, to Afghanistan and Sind. No Asiatic material being available to me I have left this question untouched.

In the case of *sibilans sibilans*, ranging from Egypt to Natal, a definite reduction in the subcaudal count from north to south is observable, this is of such a gradual nature, however, that recognition of *brevirostris* as a southern race appears unreasonable. The latter was referred to the synonymy of the former by Hewitt in 1912. In this connection it might be remarked that the character of a frontal being narrower or equal to the breadth of a supraocular has little significance in those forms where a large series of snakes have been available for study. This is shown in Table II, column 8.

The problem which caused me to undertake this revision at the present time, still remains in an unsatisfactory state. I refer to the question of how best to distinguish typical *P. s. sibilans* in East Africa from the snake which almost everyone has been calling *subtaeniatus*. True *subtaeniatus*, however, occurring south of the Zambesi is readily distinguishable from its yellow and stripe-bellied counterpart in East Africa north of the Zambesi. For this northern form I believe that Werner's name *P. subtaeniatus sudanensis* is available. In scalation the latter is practically identical with *P. s. sibilans*, but cannot be regarded as a race of *sibilans* as both occur together in the same localities though not in the same habitats. The heavier and much

larger *sibilans* is a snake of the cultivated lands, river banks, and swamps; the more elegant and slender *sudanensis* inhabits dry bush and scrub country which may be but a few hundred yards removed from the river banks where *sibilans* occurs. One has but to take two adult snakes of similar length and lay them side by side to note how much more slender is *sudanensis.* They do not represent different sexes for I have removed eggs from snakes of both types. The pair of black lines on the belly of *sudanensis* are diagnostic in many localities but not so in French West Africa or western Tanganyika.

It seems possible that *schokari* is the oldest African form having entered the continent from Arabia and spread westward to Mauretania. In Egypt or the Sudan it gave rise to two types, the slender semi-deserticolous species rather like itself which I call *subtaeniatus sudanensis,* and the heavier built *sibilans sibilans.* These two so-closely related species are, as indicated above, often difficult to distinguish in the Nile and Rift Valley regions but become more readily separable as they spread east and south. In the vicinity of Pretoria, Transvaal, typical *sibilans* gives off a western race *trinasalis* (*furcatus* auct.), which, in turn, gives off *notostictus* in Cape Province and South-West Africa and *leightoni* on the Cape Peninsula. In the forested areas of northwest Africa *sibilans* has given rise to the race *phillipsii.*

Whether *elegans* and *punctulatus* were derived from *schokari* or both from some older stock is less certain. They show close affinity, however, and *punctulatus* spreading southwards gave rise to *p. trivirgatus* and apparently *b. biseriatus* and *b. tanganicus.*

The southern group consisting of *jallae, crucifer* and *angolensis* appear to be more closely related to the *sibilans* stock while it is difficult to place the little-known *trigrammus* of southern Angola and South-West Africa until more is known of its range of variation.

The principal taxonomic changes resulting from this work—apart from the description of a new race of *biseriatus*—are the revival from synonymy of:

P. punctulatus trivirgatus Peters from synonymy of *punctulatus* Duméril & Bibron.

P. sibilans phillipsii (Hallowell) from synonymy of *sibilans* (Linné).

P. sibilans leightoni Boulenger from synonymy of *furcatus* Peters.

P. jallae Peracca from synonymy of *crucifer* (Daudin).

while the undermentioned are considered synonyms:

P. regularis Sternfeld	= *P. s. phillipsii* (Hallowell)
P. sibilans occidentalis Werner	= *P. s. phillipsii* (Hallowell)

P. moniliger furcatus Peters (not Bianconi)	= *P. s. trinasalis* (Werner)
P. ansorgii Boulenger	= *P. jallae* Peracca
P. rohani Angel	= *P. jallae* Peracca
P. longirostris V. FitzSimons	= *P. jallae* Peracca
Psammophis sibilans tumbensis Schenkel *Psammophis brevirostris temporalis* Werner	= *Dromophis lineatus* (Duméril & Bibron)

Dromophis has been included in this paper with the purpose of inviting attention to its close relationship to *Psammophis sibilans* as evidenced by its synonymy, and the references to *P. sibilans* which should properly be referred to *D. lineatus*. The two genera are readily separable by the following characters:

Maxillary teeth forming an uninterrupted series of 10 or 11 anteriorly, followed by an interspace then by a pair of enlarged grooved fangs situated beneath the posterior border of the eye . . . . *Dromophis* (p. 7.)

Maxillary teeth interrupted below the *anterior* border of the eye by two greatly enlarged fang-like teeth, separated before and behind by an interspace, followed by more small maxillary teeth then by a pair of enlarged grooved fangs situated beneath the posterior border of the eye . . . . *Psammophis* (p. 12.)

Owing to the refined discriminations of modern herpetology, it has been found impossible to construct a *Synoptical Key* comprising clear-cut distinctions. Particularly in regions where two races meet, individuals are found which exhibit an admixture of characters proclaiming their intermediate status. The *Synoptical Key* should, therefore, *be used with the greatest caution* and its conclusions checked by reference to Tables I and II; in doubtful cases the distributional range and locality records should afford assistance.

In describing characters that are variable the commoner type is given first; in the Tables this is expressed by placing the rarer variation in parenthesis, where a variation is extremely rare or somewhat questionable it is usually given as a footnote.

I take this opportunity of thanking numerous colleagues for their friendly coöperation in answering questions regarding specimens in

their care, or for the loan of material. Among these are Mons. F. Angel (Paris), Prof. O. Arcangeli (Turin), Dr. E. R. Dunn (Philadelphia), H. W. Parker (London), the late J. Roux (Bâle), G. Scortecci (Milan), R. H. Smithers (Capetown) and L. Stejneger (Washington).

Genus Dromophis

1869d. *Dromophis* Peters, Monatsb. Akad. Wiss. Berlin, p. 447 (type *praeornatus* Schlegel).

Synonymy. The two members of this genus have been referred to *Dryophylax, Chrysopelea, Philodryas* and *Psammophis* by various authors. Citations for these will be found in Boulenger, 1896d, Catalogue of Snakes, **3**, p. 149.

Maxillary teeth 10 or 11, unequal in size, median longest, decreasing in size both anteriorly and posteriorly, followed, after a short interspace, by a pair of large grooved fangs situated below the posterior border of the eye; anterior mandibular teeth longest. Head distinct from neck; eye moderate, with round pupil. Body cylindrical; scales smooth, more or less oblique, with apical pits, in 15 or 17 rows at midbody; ventrals rounded. Tail long; subcaudals in two rows.

Range. Tropical West and central southeast Africa.

Synopsis of the Species

1. Midbody scales in 17 rows; ventrals 138–159; subcaudals 83–105. . *lineatus* (p. 7.)

   Midbody scales in 15 rows 2

2. Ventrals 161–186; subcaudals 109–122; upper labials 8, fourth and fifth entering orbit; temporals 1 + 2; dorsal stripe slightly more than 1 scale in width; range Senegal to Nigeria . . . . *p. praeornatus* (p. 10.)

   Ventrals 168–190; subcaudals 126–133; upper labials 9–10, fifth and sixth or sixth and seventh entering orbit; temporals 2 + 2 or 2 + 3; dorsal stripe more than 2 scales in width; range Nigeria to French Equatorial Africa . . . . *p. gribinguiensis* (p. 11.)

Dromophis lineatus (Duméril & Bibron)

1854. *Dryophylax lineatus* Duméril & Bibron, Erpét. Gén., **7**, p. 1124: White Nile, Anglo-Egyptian Sudan.

1858c. *Psammophis sibilans* Günther (part, not Linné), Cat. Snakes Brit. Mus., p. 136.

1887b. Mocquard (part), Bull. Soc. Philom. Paris (7), **11**, p. 78.

1863. *Philodryas lineatus* Jan, Elenco Sist. Ofidi, p. 83.
1884a. Rochebrune, Faune Senegambie. Reptiles, p. 170.
1895f. *Dromophis lineatus* Boulenger, Ann. Mag. Nat. Hist. (6), **16**, p. 33.
1896d. Boulenger, Cat. Snakes, Brit. Mus., **3**, p. 149.
1897b. Boulenger, Ann. Mag. Nat. Hist. (6), **19**, p. 279.
1897e. Boulenger, Proc. Zool. Soc. London, p. 801.
1898. Johnston, British Cent. Africa, p. 361a.
1906i. Boulenger, Ann. Mus. Genova (3), **2**, p. 214.
1908b. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, pp. 217, 232.
1908. Werner, 1907, Sitz. Akad. Wiss. Wien, **116**, **1**, p. 1877.
1910a. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. i, p. 29.
1910d. Sternfeld, Mitt. Zool. Mus. Berlin, **5**, p. 64.
1911c. Boulenger, Ann. Mus. Genova (3), **5**, p. 166.
1911. Sternfeld & Nieden, Mitt. Zool. Mus. Berlin, **5**, p. 385.
1915a. Boulenger, Proc. Zool. Soc. London, p. 212.
1915c. Boulenger, Proc. Zool. Soc. London, p. 630.
1915d. Boulenger, Proc. Zool. Soc. London, p. 653.
1916f. Chabanaud, Bull. Mus. Paris, **22**, p. 376.
1917b. Chabanaud, Bull. Mus. Paris, **23**, p. 12.
1919b. Boulenger, Proc. Zool. Soc. London, p. 289.
1921a. Chabanaud, Bull. Com. Etudes Afrique Occ. Franç., p. 470.
1921b. Chabanaud, Bull. Mus. Paris, **27**, p. 524.
1922a. Angel, Bull. Mus. Paris, **28**, p. 40.
1923. Schmidt, Bull. Ann. Mus. Nat. Hist., **49**, p. 110, pl. xiii.
1924b. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc., Suppl. 3, p. 6.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 137.
1929h. Loveridge, Bull. U. S. Nat. Mus. 151, p. 32.
1933f. Angel, Les Serpens Afrique Occ. Française, p. 154.
1933h. Loveridge, Bull. Mus. Comp. Zoöl., **74**, p. 254.
1933m. Witte, Ann. Mus. Congo Belge Zool. (1), **3**, p. 93.
1934. Pitman, Rep. Faunal Survey N. Rhodesia, p. 296.
1936h. Loveridge, Field Mus. Nat. Hist. Zool. Ser., **22**, p. 254.
1937f. Loveridge, Bull. Mus. Comp. Zoöl., **79**, p. 496.
1937. Pitman, Uganda Journ., **4**, p. 227, pl. x, fig. 3, pl. J, fig. 4.
1939c. Scortecci, Gli Ofidi Velenosi dell' Africa Italiana, p. 140, figs. 76–77.
1901. *Psammophis sibilans tumbensis* Schenkel, Verh. Naturf. Ges. Basel, **13**, p. 172: Tumbo Island, French Guinea.
1902a. *Psammophis brevirostris temporalis* Werner, Verh. Zool. Bot. Ges. Wien, **52**, p. 335: Coja, Togo.

Names. Isakani (Nyakusa, Tanganyika Territory, but applied to *Psammophis* also).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a third to once and two thirds as long as the

eye; internasals one third to one half as long as the prefrontals; frontal, in the middle, narrower than, as broad as, or slightly broader than a supraocular, as long as or slightly shorter than a parietal, as long as or slightly longer or slightly shorter than its distance from the end of the snout; nostril between 2 shields; loreal once and a third to once and two thirds as long as deep; preocular 1, separated from the frontal; postoculars 2, rarely 1 or 3; temporals 1 + 1 or 1 + 2 or 1 + 3, very rarely 2 + 2 or 2 + 3; upper labials 8, fourth and fifth entering the orbit; 4, rarely 5, lower labials in contact with the anterior sublinguals which are slightly shorter than or as long as the posterior. Midbody scales in 17 rows; ventrals 138–159; anal divided; subcaudals 83–105[1].

Coloration. Above, olive; head of young with light transverse bars on the occiput and nape, these markings sometimes disappearing in the adults, pre- and postoculars and lips greenish yellow, some of the labials with black sutures; dorsal scales mostly black-edged; three greenish-yellow longitudinal lines, one on the vertebral row of scales, the others on the fourth and fifth rows; outer scale-row greenish yellow bordered above with black. Below, belly and tail greenish yellow or pale green, uniform or with a series of black dots or short *transverse* lines on the outer ends of the ventrals.

Measurements. Largest recorded measures 1090 (760 + 330) mm. (Boulenger, 1896d, p. 150).

Breeding. On May 29 at Ujiji 6 eggs measuring 15 x 6 mm. in a ♀ (Loveridge).

Diet. A frog (*Rana m. mascareniensis*) at Ujiji. (Loveridge).

Enemies. A young example taken from the mouth of a file snake (*Mehelya riggenbachi*) at Ubao (Sternfeld).

Habitat. In Central Africa at least, to judge by the numerous lakeside records, it has some such association, perhaps on account of its diet of which nothing but the above record appears to be known.

Localities. **Anglo-Egyptian Sudan:** White Nile. **Uganda:** Bussu; Gulu, Acholi; Lado Enclave; Nile Camp; Rhino Camp. **Tanganyika Territory:** Ipiana; Mwaya; Tukuyu (Langenburg); Ujiji. **Nyasaland:** Karonga's to Kondowe; Nyika Plateau. **Northern Rhodesia:** Kabinda in Lukulu River delta, Lake Bangweulu; Nyamkolo. **Belgian Congo:** Chuapa River; Faradje; Gandu; Katobwe; Kunungu; Mahagi Port; Tembwe. **French Equatorial Africa:** Diele, Alima River; Kati nr. Beldongou. **French Cameroon:** Ubao. **Nigeria:** Asaba;

[1] 78–105 according to Boulenger (1896d, p. 149), I have examined the snake with 78 and consider that the terminal point may be regenerated.

Niger River. **Dahomey:** Agouagou. **Togoland:** Coja; Kete; Misahohe; Sausane Mangu; Sokode. **Liberia.** **French Guinea:** Dixine; Kerouane; Tumbo Island. **Portuguese Guinea:** Bissau; Rio Cassine.

Distribution. Portuguese Guinea east to the Nile, south through the countries immediately bordering the Great Lakes to Nyasaland (i.e. Lake Nyasa). Boulenger's record of Coast of Zanzibar is considered definitely erroneous. Calabresi's (1916, p. 40) Bardera, Italian Somaliland snake, repeated by Scortecci, is, I imagine, a *Hemirhagerrhis kelleri*.

Dromophis praeornatus praeornatus (Schlegel)

1837. *Dendrophis praeornata* Schlegel, Essai Phys. Serp., **2**, p. 236: Walo, Senegal.
1854. *Oxyrhopus praeornatus* Duméril & Bibron, Erpét. Gén., **7**, p. 1039.
1858c. *Chrysopelea praeornata* Günther, Cat. Snakes Brit. Mus., p. 147.
1865. Günther, Ann. Mag. Nat. Hist. (3), **15**, p. 95.
1869. Jan, Icon. Gén. Ophid. pl. ii, fig. 2.
1884a. Rochebrune, Faune Senegambie. Reptiles, p. 176.
1885d. Müller, Verh. Naturf. Ges. Basel, **7**, p. 687.
1887a. Boettger, Ber. Senckenberg. Ges., p. 60.
1869d. *Dromophis praeornatus* Peters, Ofv. Kongl. Vet. Akad. Förh., p. 447.
1870. Steindachner, Sitz. Akad. Wiss. Wien, **62**, p. 333.
1890b. Müller, Verh. Naturf. Ges. Basel, **8**, p. 694.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 150.
1898. Boettger, Kat. Rept.-Samm. Mus. Senckenberg. II, p. 102.
1902b. Mocquard, Bull. Mus. Paris, **8**, p. 415.
1908b. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, pp. 218, 232.
1916f. Chabanaud, Bull. Mus. Paris, **22**, p. 376.
1917b. Chabanaud, Bull. Mus. Paris, **23**, p. 12.
1918b. Chabanaud, Bull. Mus. Paris, **24**, p. 165.
1919b. Boulenger, Proc. Zool. Soc. London, p. 289.
1921a. Chabanaud, Bull. Com. Etudes Afrique Occ. Franç., p. 470.
1921b. Chabanaud, Bull. Mus. Paris, **27**, p. 525.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 138.
1933f. Angel, Les Serpens Afrique Occ. Française, p. 156, fig. 59.

Synonymy. After having been referred to the genera *Oxyrhopus* and *Chrysopelea*, *praeornatus* became the genotype of *Dromophis* as proposed by Peters in 1869. The score of references since that date all refer to the typical form with the exception of Sternfeld's (1917, p. 477) which is applicable to the eastern race described by Angel in 1921.

Description. Rostral slightly broader than deep, visible from above; snout once and a half to once and two thirds the diameter of the eye; internasals[1] slightly more than half the length of the prefrontals; frontal, in the middle, nearly as broad as a supraocular, shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 shields; loreal once and a half to once and two thirds as long as deep, in contact with or narrowly separated from the frontal; postoculars 2; temporals 1 + 2; upper labials 8, fourth and fifth entering the orbit; 4 or 5 lower labials in contact with the anterior sublinguals, which are as long as the posterior. Midbody scales in 15 rows; ventrals 161–186; anal divided; subcaudals 109–122.

Coloration. Above, pale olive, with black transverse bands anteriorly; most regular on the head; dorsum with a red vertebral stripe slightly more than one scale in width in the middle and a dorso-lateral series of black spots; three black stripes posteriorly. Below, uniform white.

Measurements. Largest recorded measures 550 (375 + 175) mm. (Boulenger, 1896d, p. 150).

Diet. A lizard (*Eremias* sp.) in a Togo snake (Sternfeld).

Habitat. Sternfeld (1908b, p. 218) remarks that in contrast to *lineatus,* in Togoland this species occurs only in the north of the colony. Elsewhere (1917, p. 477) he states that both are snakes of the steppe.

Localities. **Nigeria:** Niger River. **Togo:** Mangu. **Gold Coast:** Accra. **Ivory Coast:** Lahou or Lahu. **French Guinea:** Kerouane; Kerroussa. **Senegal:** Dakar; Sangaleam; Satadougou; Taoue; Wallo.

Distribution. West Africa from Senegal to Nigeria.

Dromophis praeornatus gribinguiensis Angel

1917. *Dromophis praeornatus* Sternfeld (not Schlegel), Zweit. Deutschen Zent.-Afrika-Exped., **1**, pp. 409, 477.

1921b. *Dromophis praeornatus* var. *Gribinguiensis* Angel, Bull. Mus. Paris, **27**, p. 141: Gribingui region, French Equatorial Africa.

1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 141.

1933f. Angel, Les Serpens Afrique Occ. Française, p. 156, footnote.

1933. Parker, Ann. Mag. Nat. Hist. (10), **12**, p. 544.

Description. Differs from the typical form in the more numerous ventrals, subcaudals, upper labials and temporals, viz. Postoculars 2–3; temporals 2 + 2 or 2 + 3; upper labials 9–10, fifth and sixth or

[1] Fused to form a single plate in a Sangaleam snake, *fide* Chabanaud (1918b, p. 165).

sixth and seventh entering the orbit. Midbody scales in 15 rows; ventrals 168–190; subcaudals 126–133.

Coloration. Above, pale olive; a small black spot on each internasal; on the prefrontals a transverse black band, interrupted on the median suture, extends through the loreal to the third and fourth labials; a second band between the eyes reappears as a spot on the suture between the fifth and sixth labials; a third band crosses the posterior end of the frontal and supraoculars and the anterior ends of the parietals, the anterior temporals, and terminates on the suture between the seventh and eighth labials; a fourth and last band crosses the posterior half of the parietals and without contraction reaches almost to the commissure of the mouth, along the parietal suture these last two bands give off converging projections between which lies a paired yellow spot as is found in the genus *Psammophis.* Anterior two thirds of the dorsum largely uniform except for a broad brownish-red vertebral band and a lateral series of black spots upon a light ground, the darkening and contracting of the band together with a convergence of the lateral spots accompanied by a darkening of the ground colour gives rise to the three characteristic black longitudinal stripes on the posterior part of the body. Below, uniform yellowish white except for black spots on the outer ends of the ventrals which tend to form longitudinal lines in the preanal region and upon the tail.

Measurements. Largest recorded measures 547 (365 + 182) mm. from ? Logone region (Sternfeld).

Localities. **French Equatorial Africa:** Gribingui River region. **French Cameroon:** Logone (River) region? **Nigeria:** Jos.

Distribution. West Africa from Nigeria to French Equatorial Africa.

Remarks. Sternfeld (1917, p. 477) first described this snake in great detail from a specimen with doubtful locality, supposedly from Logone region south of Lake Chad, he referred it to *praeornatus* of which he rightly said it was the most easterly example known. Later it was named by Angel. More recently Parker (1933, p. 544) received two specimens from Jos. As I have no material the above description is based on the statements of these three authors. The color translated and adapted from Sternfeld's detailed description.

Genus Psammophis

1827. *Psammophis* Boie, part, in Oken, Isis, **20**, col. 521 (type *sibilans* Linné).

1868. *Phayrea* Theobald, Cat. Rept. Asiatic Soc. Mus., p. 51 (type *isabellina* = *condanarus* Merrem).

1872. *Amphiophis* Bocage, Jorn. Sci. Lisboa, **4**, p. 81 (type *angolensis* Bocage).

Synonymy. For further references to the genus *Psammophis* see Boulenger, 1896d, Catalogue of Snakes, **3**, p. 152.

Maxillary teeth 10 to 13, one or two in the middle much enlarged, fang-like, preceded and followed by an interspace, also the last or last two much enlarged, grooved, and situated below the posterior border of the eye; anterior mandibular teeth very strongly enlarged. Head distinct from neck; eye moderate or large, with round pupil. Body cylindrical; more or less oblique (scarcely so in *crucifer* and *angolensis*), with apical pits, in 11 to 19 rows at midbody; ventrals rounded. Tail long; subcaudals in two rows.

Range. Africa and southern Asia.

Synopsis of the Species

1. Midbody scales in 17 (very rarely 19) rows 2
   Midbody scales in 15 (very rarely 17[1]) rows 14

2. Upper labials usually 9 (rarely 8 or 10); usually 5 (rarely 4 or 6) lower labials in contact with the anterior sublinguals 3
   Upper labials usually 8 (rarely 7 or 9); usually 4 (rarely 5) lower labials in contact with the anterior sublinguals 8

3. Snout twice to twice and a half as long as the eye (see below for *trigrammus* also) . . . . *elegans*
   (p. 17.)
   Snout less than twice as long as the eye 4

4. Subcaudals more than 130 pairs 5
   Subcaudals less than 130 pairs 13

5. Belly finely punctate, the spots arranged transversely not linearly 6
   Belly markings, when present, consisting of a median band with or without linearly arranged dashes or spots; subcaudals less than 150 7

6. A dark vertebral stripe, no dorsolateral ones; subcaudals 158–173 . . . . . . *p. punctulatus*
   (p. 19.)
   A dark vertebral and a pair of dorsolateral stripes; subcaudals 143–163 *p. trivirgatus*
   (p. 21.)

[1]A single example of *P. crucifer* with 17 scale-rows has been recorded by Hewitt.

7. Preoculars 2, not in contact with frontal; temporals 1 + 1 or 1 + 2, rarely 2 + 1 or 2 + 2; range southern Angola and South-West Africa...... *trigrammus*

(p. 23.)

Preoculars 1, in contact with frontal, rarely 2, not in contact with frontal; temporals 2 + 2 or 2 + 3, rarely 1 + 2; range North Africa..*s. schokari*

(p. 24.)

8. Anal entire, very rarely divided.................................9

Anal divided, very rarely entire.................................10

9. Preocular 1, not in contact with frontal; nostril between 2, rarely 3 shields; range virgin forest regions from Sierra Leone to Gaboon...*s. phillipsi*

(p. 41.)

Preoculars 2, in contact with frontal, rarely 1, not in contact with frontal; nostril between 3, rarely 2 shields; range more arid regions of Angola, South-West Africa and Cape Province.................*s. notostictus*

(p. 44.)

10. Preocular 1, usually in contact with frontal; very rarely 2, rarely not in contact with frontal...11

Preocular 1, not in contact with frontal, very rarely 2, very rarely in contact with frontal...12

11. Longitudinal light lines on rear of head and side of neck; range Transvaal to South-West Africa..............................*s. trinasalis*

(p. 46.)

Transverse light bars on rear of head and side of neck; range Little Namaqualand and Peninsula..............................*s. leightoni*

(p. 49.)

12. Habit stout; belly usually uniform white or plumbeous in adult, rarely with lateral lines though young often with lateral series of dusky spots; subcaudals 78–116; range from Mauretania to Egypt south to Natal exclusive of areas occupied by the foregoing races............*s. sibilans*

(p. 30.)

Habit slender; belly always with a pair of sharply distinct parallel longitudinal lines; subcaudals 92–114; range from southern Sudan through Kenya and Tanganyika to northern Mozambique......*sub. sudanensis*

(p. 50.)

13. Ventrals 159–174; subcaudals 109–127; upper labials usually 9, fourth, fifth and sixth entering the orbit, rarely 8 or 10 with fourth and fifth or fifth, sixth and seventh entering; range from southern Mozambique to Angola and South-west Africa . . . . *sub. subtaeniatus*

(p. 55.)

14. Midbody scales in 15 rows 15
Midbody scales in 13 rows or less 18

15. Upper labials usually 9, very rarely 8 or 10; 5 (rarely 4) lower labials in contact with the anterior sublinguals; frontal, in the middle, narrower than a supraocular; range East Africa. 16 Upper labials 8 or 7; 4 lower labials in contact with the anterior sublinguals; frontal, in the middle, usually broader than a supraocular; range southern Congo and Angola southwards 17

16. Two labials, usually the fifth and sixth, entering the orbit; range eastern Kenya Colony north to Italian Somaliland and south to Tanganyika Territory in vicinity of Kilimanjaro . . . . *b. biseriatus*

(p. 60.)

Three labials, usually the fourth, fifth and sixth, entering the orbit; southern Libya east to Somaliland, south in the Central Lakes region to Tanganyika Territory . . . . *b. tanganicus*

(p. 57.)

17. Ventrals 153–177; subcaudals 97–109; upper labials 7, third and fourth entering the orbit . . . . *jallae*

(p. 62.)

Ventrals 136–158; subcaudals 62–86; upper labials usually 8, fourth and fifth entering the orbit, rarely 7, third and fourth entering . . . . . *crucifer*

(p. 64.)

18. Midbody scales in 13 rows; subcaudals 108; range Ethiopia (known only from the type) . . . . *pulcher*

(p. 67.)

Midbody scales in 11 rows; subcaudals 57–82; range Tanganyika south to Mozambique, west to Angola . . . . *angolensis*

(p. 68.)

TABLE 1

VARIATION OF SCALATION IN THE GENUS PSAMMOPHIS

Species or race	Midbody scale-rows	Ventral range	Anal divided or entire	Subcaudal range	Preocular range	Postocular range	Number of upper labials, those entering the orbit in parenthesis
elegans	17	183–203	2	152–172	1	2 (3)	9 (5, 6)
p. punctulatus	17	176–196	2	158–178	1	2	9 (5, 6) 9 (3, 4, 5) 8 (4, 5)
p. trivirgatus	17	177–197	2	143–163	1	2	9 (5, 6) 9 (3, 4, 5) 8 (4, 5)
trigrammus	17	182–197	2	132–150	2	2	9 (5, 6)
s. schokari	17 (19)	156–205	2	93–149	1 (2)	2 (3)	9 (5, 6) 10 (6, 7) 8 (4, 5)
s. sibilans	17	151–186	2 (1)	*78–121	1 (2)	2 (3)	7 (3, 4) 8 (4, 5) 9 (5, 6)
s. phillipsii	17	162–182	1	89–109	1	2 (3)	8 (4, 5)
s. notostictus	17	157–184	1 (2)	81–106	2 (1)	2 (3)	8 (4, 5) rarely 9 (4, 5, 6)
s. trinasalis	17	152–180	2	85–117	1 (2)	2 (3)	8 (4, 5)
s. leightoni	17	156–176	2	84–110	1	2	8 (4, 5)
s. sudanensis	17	148–169	2	92–114	1 (2)	2	8 (4, 5)
s. subtaeniatus	17	159–174	2	†109–127	1–2	2	9 (4, 5, 6) 8 (4, 5) 10 (5, 6, 7)
b. tanganicus	15	142–168	2	97–117	1 (2)	2	8 (3, 4, 5) 9 (4, 5, 6) 10 (4, 5, 6)
b. biseriatus	15	138–156	2 (1)	100–130	1 (2)	2	9 (5, 6) 9 (4, 5, 6) 8 (4, 5)
jallae	15	153–177	2	‡97–109	1	2 (1)	7 (3, 4)
crucifer	15 (17)	136–158	2	62– 86	1	2	8 (4, 5) 7 (3, 4)
pulcher	13	144	2	108	2	2	8 (4, 5)
angolensis	11	141–156	2	57–82	1	2 (3)	8 (4, 5) 7 (4, 5)

* 71 fide Bocage.
† 77 fide Boulenger.
‡ 77 fide Boulenger & H. W. P. but see note.

TABLE 2

Variation, and Proportions of Head Shields in the Genus Psammophis

Species or races	Variation in number of Ventrals	Variation in number of Subcaudals	Number of times diameter of eye is included in length of snout	Number of times that the loreal is longer than it is deep	Number of shields surrounding the nostril	B—Rostral broader than deep E—Rostral as broad as deep	Internasal length in relation to Prefrontal. M—much shorter.	Frontal, in middle, narrower (N), equal (E) or broader (B) than a Supraocular	Length of Frontal longer than (L), equal to (E), or shorter than (S) that of a Parietal shield	Length of Frontal longer than (L), equal to (E), or shorter than (S) its distance from end of the snout
elegans	24	28	$2-2\frac{1}{2}$	3–4	2	B-E	M	N	E-S	E-S
p. punctulatus	20	20	$1\frac{1}{2}-1\frac{2}{3}$	$2-2\frac{1}{2}$	2–3	B-E	M	N	E-S	E-L
p. trivirgatus	20	17	$1\frac{1}{2}-1\frac{2}{3}$	2–3	2–3	B-E	M	N	E-S	E-L
trigrammus	15	18	$1\frac{1}{2}-2$	$2\frac{1}{4}-3$	3	B	M	N	E-S	E-L
s. schokari	49	56	$1\frac{1}{3}-1\frac{2}{3}$	$1\frac{2}{3}-4$	2–3	B	M	N	E	E-L
s. sibilans	35	38	$1\frac{1}{3}-1\frac{2}{3}$*	$1\frac{1}{2}-2\frac{1}{2}$	2–3	B-E	M	N-E	L-E-S	E-L
s. phillipsii	20	20	$1\frac{1}{4}-1\frac{1}{2}$	$1\frac{2}{3}-2\frac{1}{2}$	2–3	B-E	M	N-E	L-E-S	L
s. notostictus	27	25	$1\frac{1}{3}-1\frac{2}{3}$	$1\frac{1}{2}-2\frac{1}{2}$	2–3	B	M	N	E-S	L
s. trinasalis	20	32	$1\frac{1}{2}-1\frac{2}{3}$	$1\frac{1}{4}-2$	2–3	B-E	M	N	L-E	L
s. leightoni	20	26	$1\frac{1}{2}-1\frac{2}{3}$	2	2–3	B-E	M	N	S	L
s. sudanensis	21	22	$1\frac{1}{2}-1\frac{2}{3}$	$2-2\frac{1}{2}$	2–3	B-E	M	N-E	L-E-S	E-L
s. subtaeniatus	15	18	$1\frac{1}{2}-1\frac{2}{3}$	$2-2\frac{1}{2}$	2–3	B-E	M	N-E	L-E-S	L
b. tanganicus	16	17	$1\frac{1}{3}-1\frac{2}{3}$	2–3†	2	B-E	M	N	E-S	L
b. biscriatus	18	33	$1\frac{1}{2}-1\frac{2}{3}$	2–3	2	B	M	N	E-S	L
jallae	24	33	$1\frac{1}{4}-1\frac{1}{2}$	$1\frac{1}{2}-2$	2–3	B-E	$\frac{1}{2}-\frac{2}{3}$	B	L-E	L
crucifer	22	24	$1\frac{1}{3}-1\frac{1}{2}$	$1\frac{1}{2}$	2	B	$\frac{1}{2}-\frac{2}{3}$	E-B	E-S	L
pulcher	. .	. .	$1\frac{2}{3}$	$1\frac{2}{3}$	2	B	M	N	S	L
angolensis	15	25	$1\frac{1}{4}-1\frac{1}{2}$	$1\frac{1}{2}-2$	2	B	$\frac{1}{2}-\frac{2}{3}$	N-B	L-S	L

* Boulenger gives twice but this appears extremely doubtful.

† Boulenger gives up to four times which must be rare indeed.

Psammophis elegans (Shaw)

1735. *Serpens Catenata* Seba, Rerum Nat. Thesauri, **2**, p. 59, pl. lx, fig. 1: "Nova Hispania."

1802. *Coluber Elegans* Shaw, Gen. Zool., **3**, p. 536: "South America" (according to Seba).

1819. *Macrosoma elegans* Leach, in Bowdich, Mission Ashanti Africa, p. 493.

1825. *Natrix elegans* Wagler, Amphib. Serp., p. lxii.

1827. *Psammophis elegans* Boie, in Oken, Isis, **20**, col. 533, 548.

1837. Schlegel, Essai Phys. Serp., **2**, p. 216.

1844. Schlegel, Abbild. Amphib., p. 130, pl. xliii, figs. 15–16.
1854. Duméril & Bibron, Erpét. Gén., **7**, pt. 1, p. 894.
1858c. Günther, Cat. Snakes Brit. Mus., p. 138.
1860. Duméril, A., Arch. Mus. Paris, **10**, p. 208, pl. xvii, figs. 10–10a.
1866a. Bocage, Jorn. Sci. Lisboa, **1**, p. 49.
1867a. Bocage (part), Jorn. Sci. Lisboa, **1**, p. 226.
1870. Steindachner, Sitz. Akad. Wiss. Wien, **62**, p. 333.
1881b. Boettger, Abh. Senckenberg. Naturf. Ges., **12**, p. 395.
1882. Müller, Verh. Naturf. Ges. Basel, **7**, p. 170.
1884a. Rochebrune, Faune Senegambie. Reptiles, p. 166.
1885d. Müller, Verh. Naturf. Ges. Basel, **7**, p. 687.
1892a. Bocage, Jorn. Sci. Lisboa (2), **2**, p. 183.
1893c. Matschie, Mitt. Fors. Gel. Deutsch Schutz., **6**, p. 212.
1895b. Boulenger, Proc. Zool. Soc. London, p. 539.
1896a. Bocage, Jorn. Sci. Lisboa (2), **4**, p. 78.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 167.
1898. Boettger, Kat. Rept.-Samm, Mus. Senckenberg. II, p. 104.
1899a. Werner, Verh. Zool. Bot. Ges. Wien, **49**, p. 148.
1902a. Werner, Verh. Zool. Bot. Ges. Wien, **52**, p. 338.
1906i. Boulenger, Ann. Mus. Genova (3), **2**, p. 214.
1908b. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, pp. 218, 233.
1917. Sternfeld, Zweit. Deutschen Zent.-Afrika-Exp., **1**, pp. 409, 480.
1918b. Chabanaud, Bull. Mus. Paris, **24**, p. 166.
1919b. Boulenger, Proc. Zool. Soc. London, p. 290.
1919d. Chabanaud, Bull. Mus. Paris, **25**, p. 567.
1921a. Chabanaud, Bull. Com. Études Afrique Occ. Franç., p. 470.
1922. Aylmer, Sierra Leone Studies, **5**, p. 15.
1925b. Flower, Proc. Zool. Soc. London, p. 971.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 141.
1933b. Angel, Bull. Mus. Paris (2), **5**, p. 69.
1933f. Angel, Les Serpens Afrique Occ. Française, p. 158, figs. 60–60b.
1884a. *Psammophis trigrammus* Rochebrune (not Günther), *loc. cit.*, p. 167.
1896c. Mocquard, Bull. Mus. Paris, **2**, p. 59.
1922a. *Psammophis schokari* Angel (not Forskäl), Bull. Mus. Paris, **28**, p. 40.

Synonymy. Individuals of this species have been referred to *trigrammus* by both Rochebrune (1884a) and Mocquard (1896c), also to *schokari* by Angel (1922a), the latter has kindly reëxamined both his and Mocquard's material and agrees with my allocation. Some of the snakes identified as *elegans* by Bocage (1867a) are undoubtedly *sibilans*.

Names. Elegant Sand-Snake (English); *baloui* (French Guinea); *sabondo* (Habbe).

Description. Rostral broader than or as broad as deep, scarcely visible from above; snout twice to twice and a half as long as the eye;

internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as or slightly shorter than a parietal, as long as or slightly shorter than its distance from the end of the snout; nostril between 2 shields; loreal three or four times as long as deep; preocular 1, usually separated from the frontal; postoculars 2, rarely 3; temporals 2 + 2 or 2 + 3, rarely 1 + 2; upper labials 9, fifth and sixth entering the orbit; 5, rarely 6, lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 17 rows; ventrals[1] 183–203; anal divided; subcaudals[2] 152–172.

Coloration. Above yellow or pale olive, head olive finely punctate or vermiculated with black; three longitudinal bands formed by black-edged scales between black lines, the median band five scales wide but narrowing anteriorly, the lateral narrower and extending to the end of the snout after passing through the eye; upper lip and sides of belly yellow, rest of belly and under tail, grayish or olive lineolated with black.

Measurements. Largest recorded measured 1750 (1060 + 690) mm. (Angel).

Longevity. 1 year, 11 months, 10 days in London zoo (Flower).

Diet. Agama (Werner, 1899a), (Sternfeld, 1908b); *Mabuya* (Sternfeld, 1908b).

Localities. **French Equatorial Africa:** Bandiagara; Dire; Kati near Bammako. **Nigeria:** Lagos. **Dahomey:** Widah. **Togoland:** Atakpame; Bismarckburg; Kete; Misahohe; Pame. **Gold Coast:** Ashanti; Fantee; Odumasi; Tumbo Island. **French Guinea:** Dixine. **Portuguese Guinea:** Bissau; Bolama. **Senegal:** Dagana in Cayor; Mpal near Saint Louis.

Distribution. West Africa from the French Sudan and Nigeria to Senegal, but not reported from Liberia, Sierra Leone, and Gambia.

Psammophis punctulatus punctulatus Duméril & Bibron

1854. *Psammophis punctulatus* Duméril & Bibron, Erpét. Gén., **7**, p. 897: Arabia. (Locality doubtful.)
1882a. Peters (part), Reise nach Mossambique, **3**, p. 123.
1895. Prato, Atti. Soc. Ital. Sci. Nat., **35**, p. 25.
1896. Anderson, Contr. Herpet. Arabia, p. 83.
1896a. Boulenger, Ann. Mus. Genova (2), **16**, p. 553.
?1896b. Boulenger, Ann. Mus. Genova (2), **17**, p. 13.

[1] Boulenger's specimen with allegedly 179 ventrals, I find has 184.
[2] Boulenger's records of 144 and 149 subcaudals have regenerated tails.

1896d. Boulenger (part), Cat. Snakes Brit. Mus., **3**, p. 159.
1898. Boettger, Kat. Rept.-Samm. Mus. Senckenberg. II, p. 104.
?1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, p. 241.
1915c. Boulenger (part), Proc. Zool. Soc. London, p. 630.
1915d. Boulenger (part), Proc. Zool. Soc. London, p. 653.
1919. Werner, Denks. Akad. Wiss. Wien, **96**, p. 506.
1925. Werner (part), 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1927. Calabresi (part), Atti. Soc. Ital. Sci. Nat., **66**, p. 55.
1928b. Scortecci, Atti. Soc. Ital. Sci. Nat., **67**, p. 305.
1930a. Scortecci, Atti. Soc. Ital. Sci. Nat., **69**, pp. 203, 213.
1930b. Zavattari, in Bono, Miss. Sci. Eritrea, p. 194.
1931a. Vinciguerra, Ann. Mus. Genova, **55**, p. 101, pl. i.
1935a. Corkhill, Sudan Govt. Mus. Publ. No. 3, p. 21.
1939c. Scortecci (part), Gli Ofidi Velenosi dell' Africa Italiana, p. 151.
1859. *Dendrophis furcata* Bianconi, Mem. Accad. Sci. Bologna, p. 500 pl. xxv; reprinted in Spec. Zool. Mossambicana, p. 276, pl. xiii: Mozambique. (Locality doubted.)

Synonymy. This distinctive species does not appear to have been confounded with any other, the majority of references to it in the literature, however, apply to the southern form.

Name. Northern Speckled Sand-Snake (English).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a half to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, much narrower than a supraocular, as long as or slightly shorter than a parietal, as long as or usually longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal nearly twice to twice and a half as long as deep; preocular 1, in contact with, rarely separated from, the frontal; postoculars 2; temporals 2 + 2 or 2 + 3; upper labials 9, rarely 8, fifth and sixth, rarely fourth and fifth or third, fourth and fifth, entering the orbit; 5 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 17 rows; ventrals 176–196; anal divided; subcaudals[1] 158–178.

Coloration. Above, yellow or white, head and nape olive-gray, buff, or reddish, uniform or speckled with black; a single black vertebral stripe along the body turning to reddish brown on tail, bifurcating anteriorly, each branch, as a black or brown streak, sometimes extending through the eye to the end of the snout; sides, belly, and underside of tail, grayish or greenish heavily speckled with black.

[1]Vinciguerra (1931a, p. 101) states that Pellegrin has reëxamined Duméril & Bibron's type and finds that the low number of 130 subcaudals results from the fact that the tip of the tail is missing.

Measurements. Largest recorded measures 1440 (850 + 590) mm., from Danakil, Ethiopia. (Vinciguerra.)

Habitat. Coastal plain to arid thorn-bush uplands.

Localities. **Anglo-Egyptian Sudan:** Butana, Kasala Province; Gebel Moya, lower Blue Nile. **Eritrea:** Agordat; Barentu; Ghinda; Monte Dongallo; Saati; Tessenei. **Ethiopia:** Gaarre, Dankali; Harrar es Saghir.

Distribution. Arabia (?) and Anglo-Egyptian Sudan south through Eritrea to northeastern Ethiopia.

Remarks. Doubts have been expressed as to whether the type actually came from Arabia, the only second record being that of Sternfeld (1908c, p. 241) from Haith al hin, Lahaj (as Lahadj), a doubtful identification in view of its being stated to have only 171 ventrals and 40 subcaudals.

Much more doubtful to me is that no second example has come from Mozambique since Bianconi described *furcata.* Peters' (1882a, p. 123) reference to a specimen from Inhambane in the Bologna Museum, presumably refers to the type of *furcata.* As the type had a single vertebral stripe, should it really have come from Mozambique, then my recognition of a southern race is rendered doubtful.

Psammophis punctulatus trivirgatus Peters

1878a. *Psammophis punctulatus* var. *trivirgatus* Peters, Monatsb. Akad. Wiss. Berlin, p. 206: Teita, Kenya Colony.
1884a. Fischer, Jahr. Hamburg. Wiss. Anst., **1**, p. 12.
1882a. *Psammophis punctulatus* Peters (part, not Duméril & Bibron), Reise nach Mossambique, **3**, p. 123.
1893b. Boettger, Zool. Anz., **16**, pp. 119, 123.
1895b. Boulenger, Proc. Zool. Soc. London, p. 537.
1895i. Boulenger, Ann. Mus. Genova (2), **15**, p. 14, pl. iv, fig. 1.
1896b. Boulenger, Ann. Mus. Genova (2), **17**, p. 13.
1896c. Boulenger, Ann. Mus. Genova (2), **17**, p. 21.
1896d. Boulenger (part), Cat. Snakes Brit. Mus., **3**, p. 159.
1896e. Boulenger, Proc. Zool. Soc. London, p. 216.
1896. Tornier, Kriechthiere Deutsch-Ost-Afrikas, p. 82.
1897g. Boulenger, Ann. Mus. Genova (2), **17**, p. 279.
1897. Tornier, Arch. Naturg., **63**, **1**, p. 65.
1898a. Boulenger, Ann. Mus. Genova (2), **18**, p. 721.
1902d. Boulenger, in Johnston, Uganda Protectorate, **1**, p. 447.
?1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, p. 241.
1910a. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. i, p. 30, fig. 32.
1912b. Boulenger, Ann. Mus. Genova (2), **5**, p. 332.

1912. Hobley, Journ. E. A. Uganda Nat. Hist. Soc., **3**, p. 51.
1915c. Boulenger (part), Proc. Zool. Soc. London, p. 630.
1915d. Boulenger (part), Proc. Zool. Soc. London, p. 653.
1924b. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc., Suppl. 3, p. 6.
1925. Werner (part), 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1927. Calabresi (part), Atti. Soc. Ital. Sci. Nat., **66**, p. 55.
1931c. Scortecci, Atti. Soc. Ital. Sci. Nat., **70**, p. 210.
1932b. Parker, Proc. Zool. Soc. London, p. 364.
1934a. Scortecci, Natura (Milano), **25**, p. 58, fig. 23.
1936j. Loveridge, Bull. Mus. Comp. Zoöl., **79**, p. 265.
1936e. Parker, Ann. Mag. Nat. Hist. (10), **18**, p. 608.
1937c. Loveridge, Proc. Acad. Nat. Sci. Philadelphia, **89**, p. 277.
1937f. Loveridge, Bull. Mus. Comp. Zoöl., **79**, pp. 493, 496.
1937. Pitman, Uganda Journ., **4**, p. 229, pl. xi, fig. 1, pl. K, fig. 1.
1938a. Pitman, Uganda Journ., **5**, p. 214.
1939a. Scortecci, Ann. Mus. Genova **63**, p. 280.
1939c. Scortecci (part), Gli Ofidi Velenosi dell' Africa Italiana, p. 151, figs. 82–83.

Synonymy. Heretofore always confounded with the typical northern race, appearing as *punctulatus* in the entire literature with the exception of Peters' reference above and that of Fischer (1884a, p. 12).

Name. Southern Speckled Sand-Snake (English).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a half to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, much narrower than a supraocular, as long as or slightly shorter than a parietal, as long as or usually longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal twice to thrice as long as deep; preocular 1, in contact with, rarely separated from, the frontal; postoculars 2; temporals 2 + 2 or 2 + 3, rarely 1 + 2; upper labials 9, rarely 8, fifth and sixth, rarely fourth and fifth or third, fourth and fifth, entering the orbit; 5 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 17 rows; ventrals 177–197; anal divided; subcaudals[1] 143–163.

Coloration. Above, yellow or white, head and nape olive-gray, buff, or reddish, uniform, or speckled with black; three black stripes along the body, the vertebral broadest and bifurcating anteriorly, each

[1] The specimens with 136, recorded by Boulenger (1896d, p. 159), and 137, recorded by Scortecci (1939a, p. 281), probably possess regenerated tails, as is certainly the case with those of 105, 110, and 118, recorded by Parker and myself.

branch, as a black or brown streak, sometimes extending through the eye to the end of the snout; sides, belly, and underside of tail, grayish or greenish heavily speckled with black.

Measurements. Largest ♂ measures 1660 (1080 + 580) mm. from Ogaden (Boulenger). Largest ♀ measures 1532 (972 + 560) mm. from Athi River, Kenya Colony (Loveridge).

Diet. Lizard (*Latastia l. revoili*) on Mt. Mbololo (Loveridge).

Habitat. Coastal plain to arid thorn-bush uplands.

Localities. **British Somaliland:** Nogal Valley; Ogaden. **Italian Somaliland:** Belat Amin; Dolo; Lugh; Villaggio Duca degli Abruzzi. **Uganda:** (see *Remarks* below). **Kenya Colony:** Athi River crossing; Guaso Nyiro; Kaliokwell; Lake Rudolf; Lodwar; Loiyangallani; Mbololo Mountain; Teita. **Tanganyika Territory:** Arusha.

Distribution. Northeastern Ethiopia south through drier regions of Kenya and Italian Somaliland to extreme northern Tanganyika Territory.

Remarks. The inclusion of this species in the Uganda list by Boulenger (1902d, p. 447) was, as pointed out by Pitman (1937, p. 229), based in all probability on material obtained extralimitally to the present boundaries of the Protectorate. It may, however, have been included on the strength of Tornier's (1896, p. 82) record of Victoria Nyanza, repeated by Sternfeld (1910a, p. 30), which I reject as being either misidentified or else with faulty data.

Psammophis trigrammus Günther

1865. *Psammophis trigrammus* Günther, Ann. Mag. Nat. Hist. (3), **15**, p. 95, pl. ii, fig. E: Rio Sao Nicolao, Mossamedes Bay, Angola.
1887a. Bocage, Jorn. Sci. Lisboa, **11**, p. 206.
1895b. Boulenger, Proc. Zool. Soc. London, p. 538.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 159.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 513.
1910b. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. 1, p. 26, fig. 30.
1910c. Sternfeld, Mitt. Zool. Mus. Berlin, **5**, p. 56.
1911. Lampe, Jahrb. Nassau Verh. Naturk. Wiesbaden, **64**, p. 201.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 123, 124.
1915c. Werner, in Michaelsen, Beitr. Kennt. D.-Südwestafrikas, p. 364.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.

Synonymy. This rare species does not appear to have been confounded with others, but the references to its occurrence in Senegal by Rochebrune, and French Guinea by Mocquard, might be attributed to *elegans* if they were based on actual misidentified material.

Description. Rostral broader than deep, visible from above; snout once and a half to twice[1] as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as or a little shorter than a parietal, as long as or longer than its distance from the end of the snout; nostril between 3 shields; loreal two and a quarter to thrice as long as deep; preoculars 2, in contact with or just separated from the frontal; postoculars 2; temporals 1 + 1 or 1 + 2, rarely 2 + 1 or 2 + 2; upper labials 9, fifth and sixth entering the orbit; 5 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 17 rows; ventrals 182–197; anal divided; subcaudals 132–150.

Coloration. Above, pale olive or grayish brown, yellowish posteriorly; upper lip, pre- and postoculars yellowish; dorsum uniform or the scales on the vertebral line black-edged, forming a stripe posteriorly; an indistinct dark lateral stripe or series of black dashes along the outer scale-row. Below, as well as lower half of outer scale-row, white or yellowish with a well-defined median band of olive or light gray; chin and throat pure white.

Measurements. The type, a ♂ and largest known specimen, measures 1180 (750 + 430) mm.

Localities. **Angola:** Rio Sao Nicolao. **South-West Africa:** Kuibis; Omaruru; Rehbock; Seafontein.

Distribution. Southern Angola and South-West Africa.

Remarks. The type locality is *not* in Namaqualand, the correction was made by Bocage (1887a, p. 206) but has had little attention.

Psammophis sibilans schokari (Forskål)

1735. *Serpens Africana* Seba, "Rerum Nat. Thesauri," **2**, p. 57, pl. lvi, fig. 4: Hippo, *i.e.* Bone, Algeria.
1755. *Coluber hipponensis* Klein, Tentam Herpet. Unzeri, pp. 38, 117: Hippo (Based on Seba's figure).
1775. *Coluber schokari* Forskål, Descript. Animal., p. 14: Yemen, Arabia.
1825. *Natrix schokari* Wagler, Amphib. Serp., p. lxii.
1834. *Coluber lacrymans* Reuss, Mus. Senckenberg., **1**, p. 139: Tor district, Arabia, *i.e.* Tor, Sinai Peninsula, Egypt.
1854. *Psammophis moniliger* Duméril & Bibron (part, not Daudin), Erpét. Gén., **7**, p. 891.
1854. *Psammophis punctatus* Duméril & Bibron, Erpét. Gén., **7**, p. 896, pl. lxxvii, fig. 2: Levant; Egypt; Arabia; Red Sea coasts.

[1] Type examined for this character A. L.

1857. Gervais, Mém. Acad. Sci. Montpellier, **3**, p. 512, pl. vb, figs 3–3a..
1862b. Peters, Monatsb. Akad. Wiss. Berlin, p. 274, pl. –, fig. 2.
1862b. Strauch, Mém. Acad. Imp. Sci. Pétersbourg (7), **4**, p. 66.
1858c. *Psammophis sibilans* Günther (part, not Linné), Cat. Snakes Brit. Mus., p. 136.
1862b. Strauch, Mém. Acad. Imp. Sci. Pétersbourg (7), **4**, p. 66.
1875. Schreiber (part), Herpet. Europaea, p. 217.
1880d. Peters, Monatsb. Akad. Wiss. Berlin, p.308.
1881a. Peters, in Rohlfs, Kufra, p. 369.
1885d. Müller, Verh. Naturf. Ges. Basel, **7**, p. 686.
1891c. Boulenger, Trans. Zool. Soc. London, p. 150.
1892. Anderson, Proc. Zool. Soc. London, p. 19.
1894. Oliver, Mém. Soc. Zool. France, **7**, p. 121.
1896. Doumergue, Ass. Franc. Compte Rendu 25th Sess. Carthage, p. 478.
1896a. Oliver, Assoc. Franc. Compte Rendu 25th Sess. Carthage, p. 474.
1896b. Oliver, Revue Sci. Bourbonnais France, **9**, p. 125.
1903. Mayet, in Explor. Sci. Tunisie, p. 24.
1904. Chaignon, Bull. Soc. Hist. Nat. Autun, **17**, p. 24.
1916. Andersson (part), Meddel. Göteb. Musei Zool. Afdel., No. 9, p. 36.
1920c. Chabanaud, Bull. Mus. Paris, **26**, p. 462.
1863. *Psammophis sibilans* var. *hierosolimitana* Jan, Elenco Sist. Ofidi, p. 90: Jerusalem, Palestine.
1870. Jan, Icon. Gén. Ophid., livr. 34, pl. iii, fig. 2.
1872. *Psammophis sindanus* Stoliczka, Proc. Asiatic Soc. Bengal, p. 83: Sind and Cutch (as Katch), northwest India. (*non vidi.*)
1885b. *Psammophis sibilans* var. *punctata* Boettger, in Kobelt, Reise. Algerien Tunis. p. 462.
1891c. Boulenger, Trans. Zool. Soc. London, p. 97.
1892. König, Sitz. Nied. Ges. Natur. Bonn, p. 23.
1896a. Boulenger, Ann. Mus. Genova (2), **16**, p. 553.
1896d. *Psammophis schokari* Boulenger, Cat. Snakes Brit. Mus., **3**, p. 157.
1896. Anderson, Contr. Herpet. Arabia, pp. 53, 82, 108.
1897b. Werner, Verh. Zool. Bot. Ges. Wien, **47**, p. 407.
1898. Anderson, Zool. Egypt. **1**, Rept. Batr., p. 295, pls. xli-xlii.
1898. Boettger, Kat. Rept.-Samm. Mus. Senckenberg. II, p. 103.
1900. Anderson, Ann. Mag. Nat. Hist. (7), **6**, p. 425.
1901a. Doumergue, Soc. Geog. Arch. Oran, **20**, p. 61.
1901. Schenkel, Verh. Naturf. Ges. Basel, **13**, p. 172.
1901. Steindachner, Denks. Akad. Wiss. Wien, **69**, p. 334.
1903. Günther, Novit. Zool., p. 299.
1903. Steindachner, Sitz. Akad. Wiss. Wien, **112**, **1**, p. 10.
1904. Chaignon, Bull. Soc. Hist. Nat. Autun, **17**, p. 24.
1904. Peracca, Bull. Mus. Zool. Torino, **19**, No. 467, p. 4.
1905g. Boulenger, Novit. Zool., **12**, p. 77.

1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, p. 241.
1908. Werner, 1907, Sitz. Akad. Wiss. Wien, **116**, **1**, p. 1878.
1908. Zulueta, Boll. Real. Soc. Esp. Hist. Nat., **8**, p. 455.
1909b. Werner, Third Rep. Wellcome Res. Lab. Khartoum, pp. 622, 631.
1911. Lampe, Jahrb. Nassau Ver. Naturk. Wiesbaden, **64**, p. 201.
1913. Ghigi, Mem. Accad. Sci. Inst. Bologna (6), **10**, p. 284.
1913. Hartert, Novit. Zool., **20**, p. 83.
1913a. Werner, in Brehm, Tierleben, **4**, ed. 4, p. 400.
1914. Barbour, Proc. New Eng. Zoöl. Club, **4**, p. 91.
1914. Fowler, Copeia, p. 1.
1914b. Werner, Sitz. Akad. Wiss. Wien, **123**, **1**, pp. 346, 354.
1915d. Boulenger, Proc. Zool. Soc. London, p. 653.
1915e. Boulenger, Proc. Zool. Soc. London, p. 80.
1916c. Chabanaud, Bull. Mus. Paris, **22**, p. 79.
1919b. Boulenger, Proc. Zool. Soc. London, p. 290.
1919c. Boulenger, Proc. Zool. Soc. London, p. 305.
1922a. Angel, Bull. Mus. Paris, **28**, p. 40.
1922. Foley, Bull. Soc. Hist. Nat. Afrique Nord, **13**, p. 75.
1922a. Mertens, Senckenbergiana, **4**, p. 181.
1924a. Chabanaud, Bull. Mus. Paris, **30**, p. 55.
1925b. Flower, Proc. Zool. Soc. London, p. 971.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1926b. Mertens, Zool. Anz., **68**, p. 326.
1926. Morton, Bull. Soc. Vaudoise Sci. Nat., **56**, p. 187.
1926a. Pellegrin, 1925, Bull. Soc. Sci. Nat. Maroc., **5**, p. 319.
1927a. Pellegrin, Compte Rendu Assoc. Franc. Avanc. Sci., **51**, p. 263.
1927. Vinciguerra, Ann. Mus. Genova, **52**, p. 343.
1928. Mosauer & Wallis, Zool. Anz., **79**, p. 207, fig. 10.
1928b. Scortecci, Atti. Soc. Ital. Sci. Nat., **67**, p. 305.
1929b. Werner, Sitz. Akad. Wiss. Wien, **138**, **1**, pp. 12, 26.
1929. Zavattari, Notiz. Econom. Cirenaica, p. 88.
1930a. Scortecci, Atti. Soc. Ital. Sci. Nat., **69**, pp. 203, 213.
1930a. Zavattari, Arch. Zool. Ital. Torino, **14**, p. 279.
1930b. Zavattari, in Bono, Miss. Sci. Eritrea, p. 194.
1931. Gestro & Vinciguerra, Result. Sci. Miss. Oasi Giarabub, p. 538.
1931b. Vinciguerra, Ann. Mus. Genova, **55**, p. 257.
1931c. Werner, Sitz. Akad. Wiss. Wien, **140**, **1**, p. 301.
1932. Angel, Bull. Mus. Paris (2), **4**, p. 387.
1932b. Parker, Proc. Zool. Soc. London, p. 364.
1932b. Scortecci, Atti. Soc. Ital. Sci. Nat., **71**, p. 46.
1933f Angel, Les Serpens Afrique Occ. Française, p. 160.
1933. Flower, Proc. Zool. Soc. London, p. 823.
1934. Mosauer, Publ. Univ. Cal. Biol. Sci., **1**, p. 58.
1934a. Scortecci, Natura (Milano), **25**, p. 57, fig. 22.
1935a. Corkhill, Sudan Govt. Mus. Publ. No. 3, p. 21.

1935.	Foley, Bull. Soc. Hist. Nat. Afrique Nord, **26**, p. 54.
1935.	Hediger, Verh. Naturf. Ges. Basel, **46**, p. 27.
1935.	Laurent, Bull. Soc. Hist. Nat. Afrique Nord, **26**, p. 347.
1935d.	Scortecci, Atti. Soc. Ital. Sci. Nat., **74**, p. 194.
1935e.	Scortecci, Atti. Soc. Ital. Sci. Nat., **74**, p. 189.
1937.	Zavattari, in Festschrift Geburt Embrik Strand, **2**, p. 532.
1938b.	Angel, Bull. Mus. Paris (2)., **10**, p. 487.
1938.	Angel & Lhote, Bull. Com. Études Afrique Occ. Franç., **21**, p. 367.
1939c.	Scortecci, Gli Ofidi Velenosi dell' Africa Italiana, p. 154, figs. 84–85.

Synonymy. Except for citations of new species, the above synonymy is restricted to African references, some few earlier ones will be found in Duméril & Bibron (1854).

Boulenger referred Seba's figure to *sibilans,* to which it certainly has a more general resemblance than to *schokari,* though some examples of the latter exhibit temporal blotches, as figured by Seba, which are more characteristic of the typical form. The locality, however, assuming that it is correct, definitely places the specimen as representing the race *schokari.* Klein's name *hipponensis,* being preLinnaean, is inadmissable.

The confusion of this form with typical *sibilans* has been extensive, so that many references to *sibilans* are referable to *schokari,* though only a few of the latter are relegated to the synonymy of *P. s. sibilans.* Chabanaud's (1916f) record from Dahomey, which later he (1917b) corrected to Timbuktu on the Niger, as well as Angel's (1922a) from Kati, near Bamako on the Niger, are referred to *elegans.* A disposition with which Mons. Angel concurs.

Names. Schokari Sand-Snake (English); *zeurig* (Arabic, Algeria); *kebeli* (Arabic, Tunisia); *abu el suyur* (*i.e.* father of stripes, Arabic, Egypt); *abu far, abu sa aifa, um sot, zerrag* (Arabic, Sudan); *schokari* (Arabic, Arabia); *kung* (Nubas of Karko). Mostly after Corkhill.

Description. Rostral broader than deep, visible from above; snout once and a third to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as a parietal, as long as or slightly longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal once and two thirds to four times as long as deep; preocular 1, rarely 2, in contact with, rarely separated from, the frontal; postoculars 2, rarely 3; temporals 2 + 2 or 2 + 3, rarely 1 + 2; upper labials 9, rarely 8 or 10, fifth and sixth, rarely fourth and fifth or sixth and seventh, entering the orbit; 5, rarely 4 or 6, lower labials in contact

with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 17, rarely 19, rows; ventrals 156–205; anal divided; subcaudals 93–149.[1]

Coloration. Very variable. Above, reddish, yellowish, grayish, or pale olive; usually a dark streak on each side of the head passing through the eye; lips with or without dark spots; body striped or spotted with darker, sometimes uniform. Below, uniform or spotted with darker, laterally with or without one or two rows of more or less distinct dark lines or series of dashes, sometimes enclosing a central, ribbon-like grayish streak.

Doumergue (1901a) describes seven colour phases from Algeria, and states that all may be present in a single locality! More recently Mertens (1926b) has discussed dichromatism in this race.

Measurements. Largest ♂ measures 1480 (1145 + 335) mm. Presumably from Egypt (Anderson, 1898, p. 297).

Longevity. Record for thirty-five snakes at Giza zoo was 11 months and 24 days (Flower, 1925b, p. 971).

Diet. Chiefly lizards, but bird in mouth of one (Corkhill, 1935a, p. 21); lizard (*Acanthodactylus s. aureus*) at Port Etienne (Chabanaud, 1924a, p. 55); skink (*Chalcides ocellatus*) at Ain Sefra (Werner, 1914b, p. 346). Captive snakes took lizards (*Lacerta muralis* and *L. vivipara*) (Mosauer, 1934, p. 58), but refused gerbils.

Parasites. Hemogregarines in 2 out of 5 Algerian snakes (Foley, 1922, p. 75).

Temperament. Inoffensive (Doumergue, 1901a, p. 61) and placid (Corkhill, 1935a, p. 21), though natives very much afraid of them (Werner, 1913a, p. 400).

Venom. Captive examples observed to swallow lizards instantly without attempting to poison or constrict them (Mosauer, 1934, p. 58).

Habitat. In Algeria this species is deserticolous, being found beneath stones or among the scrubby vegetation of the dunes (Doumergue, 1901a, p. 61). In Egypt in dry areas, never in the moist alluvial soil of the fields (Anderson, 1898, p. 297), it is widespread though "not found in the Nile Delta, nor in cultivated or marshy land, it inhabits dry deserts, especially tracts with a certain amount of scattered vegetation. It appears to be diurnal . . ." (see Flower, 1933, p. 823). Its tracks are figured by Mosauer and Wallis (1928, fig. 10).

[1] This count of 149 is from Aden and has been checked by me, other high counts—141 and 140—are also from Arabian localities, yet some Arabian specimens in the Mus. Comp. Zoöl. have as few as 115 and 116 subcaudals. Asiatic material tends to be higher for the largest count for an African snake is that of 131 (checked as 128, but tip now missing) for a Brit. Mus. snake said to be from Dourat, Tunisia.

Localities. **French West Africa:** Ajoujt (Akjoujt); Port Etienne. **Rio de Oro. French Morocco:** Berguent; Dar Kaid Embarek; Djebel Guelis; Marrakesh; Mogador; Tamarouft (Tamaruth) Valley; Taourit. **Algeria:** Ain Oumach; Ain Sefra; Amsel; Arba Tahtani; *Banion (? Beni Ounif); Beni Mzab; Beni Ounif de Figuig; Bled el Ahmar; Biskra; Bone; *Bou Guelfaia (? Guelatia); Bou Saada; El Abiod Sidi Cheikh; Figuig; In Salah; Ksar el Ahmar; Laghouat; Messad; Mzab; Oued Mya; Reggan; Sefissifa (Sfissifa); Tuggurt; *Zaatcha. **Tunisia:** Bled Thala; *Bordj Gonifla; Bou Grara; Djebel Domeur; Djebel Meda; Douirat; El Hamma (Hamman) des Beni Zib; *Fratis; Gabes (Cabes); Gafsa; Mejerda (Madjoura); Metamer; *Nebech el Dib; *Raz el Wed (? Ras el Oued, Algeria); Shott el Djerid (Jerid); *Taferma; Tamezret (Tamesred); Tozeur (Toser). **Libya:** Agial; Ain Ghazal nr. Auenat; Bir Milrha to Giofra (Kufra); Archenu to Auenat; El Auenat; *El Foga (Fogha); El Tag; Gebel Nari (Neri); Gialo; Giarabub; Giarabub to Porto Bardia; Giofra; Hofra; Misurata; Oasi Bzema; Rebiana; Tripoli; Uadi el Abiad. **Egypt:** Abbasa (Abbasiyeh); *Abu Roash; Abu Shah; Ain Musa; Aswan (Assuan); Beris (Berys); Cairo; Emerald Mines; Etsa district; Giza; Ismailia; Kantara; Kharga Oases; Libyan Desert; Mariut; Mersa (Marsa) Matruh; Ras Gharib; Salhia Desert; Sennures district; Shadwan Island; Shaluf; Suez; Wadi Feiran; Wadi Halfa; Wadi Hebran; Wadi Hellal; Wadi Natrun; Wadi Um Tundeba (Tundeb). **Anglo-Egyptian Sudan:** Dongola; Durur; Fung; Khartoum; Sennar; Suakin; Tokar. **Eritrea:** Asmara; Cheren; Cheren to Massaua; Monte Dangollo nr. Ghinda; Saati (Sahiti); Tessenei. **British Somaliland:** Buran; Warabod (Warabot). **Italian Somaliland:** Carim (Carin).

Distribution. Arid areas bordering the Sahara, from French West Africa adjacent to Rio de Oro, west to Egypt (also Arabia; Syria; Palestine; Mesopotamia; Persia; Baluchistan; Afghanistan and Sind), south along the Red Sea coast to Italian Somaliland.

In British Somaliland it has been recorded from 600 to 3,000 feet (Parker, 1932b, p. 364), in Sinai up to 5,300 feet.

It will be noted that this race, as well as typical *P. s. sibilans*, have been recorded from Cairo and its environs—Abbasa (Abbasiyeh), Abu Roash and Giza—as well as from Aswan, Egypt; Khartoum and Sennar in the Sudan; and Cheren in Eritrea. This is not so incomprehensible in view of the marked habitat differences which have been em-

[1] Localities marked with an asterisk have not been located on any map, all others on this page have been found, preference being given to spelling in atlas, that of herpetologist following in parenthesis.

phasized by both Anderson and Flower. Habitat preferences which are paralleled in East Africa by *P. s. sibilans* along the rivers and *P. subtaeniatus sudanensis* in the arid bush a few hundred yards removed from such rivers or swamps.

I wish that someone with abundant Egyptian or Eritrean material would make a critical study of all the records of both *sibilans* and *schokari* in those countries and see if they are correlated with the physical features suggested.

Remarks. The fullest discussion on variation in this race will be found in Anderson (1898, pp. 295–302) who suggests that *schokari* differs from *sibilans* in displaying a less marked disparity in size as between the scales of the first and fourth lateral rows, while in *sibilans* the fourth row is only about half the size of that of the first, or lowest.

Psammophis sibilans sibilans (Linné)

1758. *Coluber sibilans* Linné (part), Syst. Nat., ed. 10, **1**, p. 222: "Asia."
1766. Linné (part), Syst. Nat., ed. 12, **1**, p. 383.
1802. *Coluber Gemmatus* Shaw, Gen. Zool., **3**, p. 539: No locality.
1803. *Coluber moniliger* Daudin, Hist. Nat. Rept., **7**, p. 69: No locality.
1820. *Natrix sibilans* Merrem, Vers. Syst. Amphib., p. 114.
1827a. *Coluber auritus* Geoffroy Saint-Hilaire, Descr. Egypte, **1**, Hist. Nat., Rept., pp. 147, 151, pl. viii, fig. 4: Egypt.
1829. Geoffroy Saint-Hilaire, Suppl., pl. iv, fig. 5.
1827. *Psammophis sibilans* Boie, in Oken, Isis, **20**, col. 547.
1858c. Günther, Cat. Snakes Brit. Mus., p. 136.
1866a. Bocage, Jorn. Sci. Lisboa, **1**, p. 48.
1867a. Steindachner, in Reise Osterreich. Freg. Novara, Zool., **1**, p. 69.
1870. Blanford, Obs. Geol. Zool. Abyssinia, p. 458.
1870. Jan, Icon. Gén. Ophid., livr. 34, pl. iii, fig. 3.
1870b. Peters, Monatsb. Akad. Wiss. Berlin, p. 114.
1870. Steindachner, Sitz. Akad. Wiss. Wien, **62**, p. 333.
1875a. Peters, Monatsb. Akad. Wiss. Berlin, p. 198.
1875. Schreiber (part), Herp. Europaea, p. 217.
1876a. Peters, Monatsb. Akad. Wiss. Berlin, p. 118.
1877c. Peters, Monatsb. Akad. Wiss. Berlin, p. 615.
1878a. Peters, Monatsb. Akad. Wiss. Berlin, p. 206.
1881b. Boettger, Abh. Senckenberg., Naturf. Ges., **12**, p. 395.
1882. Müller, Verh. Naturf. Ges. Basel, **7**, p. 170.
1882a. Peters, Reise nach Mossambique, **3**, p. 121.
1882a. Vaillant, in Révoil, Faune Flore Pays Çomalis, p. 24.
1884a. Rochebrune, Faune Senegambie. Rept., p. 165.
1885d. Müller (part), Verh. Naturf. Ges. Basel, **7**, p. 78.

1886. Dollo, Bull. Mus. Royal Belg., **4**, p. 156.
1887b. Boettger, Ber. Senckenberg. Ges., p. 159.
1887h. Boulenger, Zoologist (3), **11**, p. 176.
1887b. Mocquard (part), Bull. Soc. Philom. Paris (7), **11**, p. 78.
1887. Symonds, Proc. Zool. Soc. London, p. 487.
1888a. Boettger, Ber. Senckenberg. Ges., p. 53.
1888a. Günther, Proc. Zool. Soc. London, p. 51.
1889. Hesse, Zool. Garten, **30**, p. 266.
1889. Pfeffer, Jahrb. Hamburg. Wiss. Anst., **6**, p. 9.
1891b. Steindachner, Sitz. Akad. Wiss. Wien, **100**, **1**, p. 314.
1892a. Bocage, Jorn. Sci. Lisboa (2), **2**, p. 183.
1892a. Boulenger, in Distant, Natur. in Transvaal, p. 176.
1893b. Boettger, Zool. Anz., **16**, pp. 119, 123.
1893. Pfeffer, Jahrb. Hamburg. Wiss. Anst., **10**, p. 86.
1894. Fleck, Ber. Senckenberg. Ges., p. 85.
1894. Günther, Proc. Zool. Soc. London, p. 88.
1894a. Günther, 1893, Proc. Zool. Soc. London, p. 618.
1895a. Bocage (part), Herp. Angola Congo, p. 114.
1895b. Boulenger, Proc. Zool. Soc. London, p. 537.
1895. Jeude, Notes Leyden Mus., **16**, p. 229.
1896. Anderson, Contr. Herp. Arabia, p. 108.
1896a. Bocage, Jorn. Sci. Lisboa (2), **4**, pp. 78, 93.
1896b. Bocage, Jorn. Sci. Lisboa (2), **4**, p. 113.
1896e. Bocage, Jorn. Sci. Lisboa (2), **4**, p. 177.
1896a. Boulenger, Ann. Mus. Genova (2), **16**, p. 553.
1896b. Boulenger, Ann. Mus. Genova (2), **17**, p. 13.
1896c. Boulenger, Ann. Mus. Genova (2), **17**, p. 21.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 161.
1896. Peracca, Boll. Mus. Zool. Torino, **11**, No. 255, p. 2.
1896. Tornier, Kriechthiere Deutsch-Ost-Afrikas, p. 82.
1897. Bateman, The Vivarium, p. 285.
1897b. Boulenger, Ann. Mag. Nat. Hist. (6), **19**, p. 279.
1897e. Boulenger, Proc. Zool. Soc. London, p. 801.
1897g. Boulenger, Ann. Mus. Genova (2), **17**, p. 279.
1897a. Peracca, Boll. Mus. Zool. Torino, **12**, No. 273, p. 3.
1897b. Peracca, Boll. Mus. Zool. Torino, **12**, No. 304, p. 2.
1897. Sjöstedt, Bihang Kongl. Svenska Vet.-Akad. Handl., **23**, pt. 4, No. 2, p. 35.
1897. Tornier, Arch. Naturg., **63**, p. 65.
1897b. Werner, Verh. Zool. Bot. Ges. Wien, **47**, p. 400.
1898. Anderson, Zool. Egypt, **1**, Rept. Batr., p. 302, fig. 12, pl. xliii.
1898. Boettger, Kat. Rept.-Samm. Mus. Senckenberg. II, p. 104.
1898. Johnston, British Cent. Africa, p. 361a.
1898. Sclater, Ann. S. African Mus., **1**, p. 100.
1898. Werner, 1896–7, Jahrb. Abh. Natur. Magdeburg, p. 145.

1898. Werner, Verh. Zool. Bot. Ges. Wien, **48**, p. 212.
1899. Mocquard, Bull. Mus. Paris, **5**, p. 219.
1900b. Boulenger, Proc. Zool. Soc. London, p. 454.
1900. Flower, Proc. Zool. Soc. London, p. 968.
1901. Schenkel, Verh. Naturf. Ges. Basel, **13**, p. 172.
1902b. Boulenger, Proc. Zool. Soc. London, **2**, p. 18.
1902d. Boulenger, in Johnston, Uganda Protectorate, p. 447.
1902. Lampe & Lindholm, Jahrb. Nassau Ver. Naturk. Wiesbaden, **55**, p. 34.
1902b. Mocquard, Bull. Mus. Paris, **8**, p. 406.
1902a. Scherer, Blätt. Aquar.-Terr. Kunde, **13**, p. 254.
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Synonymy. Linné's type of *sibilans*, still in existence in Upsala Museum, has been figured by Anderson (1898, p. 306, fig. 12) and its identity well established.

In addition to the synonyms listed above, typical *sibilans* has been recorded as *elegans* (not Shaw), *punctatus* (not Duméril & Bibron), *furcatus* (not Peters), and *subtaeniatus* (not Peters).

On the other hand, references to *sibilans* in the literature are referred by me to every one of its subspecies as recognized here, as well as to both forms of *subtaeniatus* and to *bitaeniatus tanganicus*. Linné himself, by his reference to Seba, confused it with *crucifer*.

The findings of Hewitt (1912, p. 272), who adduced good evidence for the synonymizing of *brevirostris* with *sibilans* appear to have been overlooked or disregarded by later workers who have continued to record *brevirostris* from Togo, Cameroon, Congo, and elsewhere. My own references (1916a, 1917h, 1918a) to *brevirostris* as occurring near Nairobi are referable to the snake which I later described as *Trimerorhinus tritaeniatus multisquamis*. Though there is a very slight average difference in the subcaudal counts of *sibilans* from Egypt and Natal, it is insufficient to warrant recognition of a southeastern race. Werner's *P. brevirostris temporalis* is referred to *Dromophis lineatus*.

Names. Neither of the English names for this snake are very fortunate, that of Beauty Snake, proposed by Flower (1933) is inappropriate for the olive or dun coloured reptiles of East Africa, while the generic term Sand-Snake is less applicable to the typical race than to its more deserticolous congeners like *schokari* and *notostictus*.

Hissing Sand-Snake or African Beauty Snake (English). In the central Sudan it is not distinguished from the preceding race, being, according to Corkhill, called *abu far, abu feiran, abu sa aifa, um sot* and *zerrag* (Arabic, Sudan); mayitt and tomai (Hadendoa, Sudan, for uniform and striped varieties respectively); *burusam* (Nubas of Tindia); *achel* (Tourareg, French Sudan); *danesnona* (Peulh, French Sudan); *sabondo* (Habbe, French Sudan); *sadie* (Bambara, French Sudan); *enyeneropi* (Teso, Uganda); *sebusaru* (Toro, Uganda); *karwekarwe* or *kalwekalwe* (Ganda, Uganda); *namasanurugi* (Gishu, Uganda); *aerenet* (Elgonyi Masai, Kenya); *ndasiangombe* (Teita, Kenya); *jukaa* or *paa* (Pokomo, Kenya); *yamuwe* (Nyamwezi, Tanganyika); *nyalwinzi* or *nyulsenga* (Yeye, Tanganyika); *nne* (Sandawi, Tanganyika); *nyamkando* (Gogo, Tanganyika); *mlalu* (Rungu, Tanganyika); *ngaruka* (Nyakusa, Tanganyika); *nachungu* (Makonde and Yao, Tanganyika); *swaga* (Swahili, Tanganyika); *musaluhe* (Mozambique); *surira* (Chisena, Mozambique); *suela* (Benguela, Angola); *blaas zand-slang* (Afrikaans, Transvaal).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a third to twice[1] as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than or equal to a supraocular, as long as or slightly longer or shorter than a parietal, as long as or slightly longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal once and a half to twice and a half as long as deep; preocular 1, rarely 2, usually sepa-

[1] Twice according to Boulenger; once and two thirds my longest. A. L.

rated from, rarely in contact with, the frontal; postoculars 2, rarely 3; temporals 2 + 2 or 2 + 3, rarely 2 + 1, 1 + 1, 1 + 2, or 3 + 3; upper labials 8, rarely 7 or 9, fourth and fifth, rarely third and fourth, fifth and sixth, or fourth, fifth and sixth,[1] entering the orbit; 4, rarely 5, lower labials in contact with the anterior sublinguals, which are shorter than or as long as the posterior. Midbody scales in 17 rows; ventrals 151–186[2]; anal divided, rarely entire; subcaudals[3] 78–121.

Coloration. Very variable. Boulenger (1896d) furnishes descriptions of six color forms, and the literature teems with variants of these.

Above, olive, brown, or yellowish; head of young usually with yellow, black-edged longitudinal streaks anteriorly and transverse ones posteriorly, these markings usually disappearing in the adults; lips yellowish white with, or without, dark spots; body usually uniform or with a narrow yellow vertebral line and a yellow band along each side of the back. Below, plumbeous gray or yellowish white, uniform, or young with a series of dusky lateral dashes longitudinally arranged, or adults (in Central Lake Region and Sudan) with a faint brown lateral line, rarely distinct as in *subtaeniatus;* some Angolan specimens exhibit short horizontal dashes corresponding with each ventral as in *Dromophis lineatus.* The pigmentation of the iris, arrangement of vessels and circular pupil are described by Mann (1931).

Measurements. Largest ♂ measures 1500 mm. from Belgian Congo (Schmidt); largest ♂ for Tanganyika measures 1482 (1120 + 362) mm., and largest ♀ measures 1504 (1100 + 404) mm., both from Morogoro (Loveridge); largest Egyptian example measures 1445 mm. (Flower).

Breeding. In Northern Rhodesia Pitman observed a mating pair in the Luangwa Valley, July 20; while a recently hatched brood were encountered at Broken Hill on September 24.

On November 29 at Butiaba	? eggs measuring 17x11 mm. in a ♀.
On December 13 at Sipi	4 eggs measuring 13x 6 mm. in a ♀.
On December 21 at Bundibugyo	9 eggs measuring 15x 9 mm. in a ♀.
On January 18 at Butandiga	10 eggs measuring 27x10 mm. in a ♀.
On January 18 at Butandiga	7 eggs measuring 38x19 mm. in a ♀.

These last were ready for deposition. All four localities are in Uganda (Loveridge).

Longevity. 10 years, 4 months, and 2 days in Giza zoo (Flower).

Diet. Young snakes live on frogs and lizards, adults on mammals,

[1] On one side in a Paderburn snake recorded by FitzSimons (1938).
[2] 198 recorded for a Zanzibar snake by Boulenger, rechecked as 168.
[3] 41 of Monard (1937b) and 71 of Bocage, probably regenerated tails.

and occasionally birds if Fleck's (1894) record of a titmouse (*Parus afer*) is accepted. For detailed account of feeding habits, see Loveridge (1928g) from whom the following records are taken.

Frog (*Rana m. mascareniensis*) at Nyamkolo, and (*Arthroleptis minutus*) at Mwaya; geckos (*Hemidactylus mabouia*) at Morogoro; tree agama (*Agama atricollis*) at Bukori; lizards (*Nucras b. boulengeri*) in Unyanganyi, (*Eremias s. spekii*) at Mangasini; yellow-throated lizard (*Gerrhosaurus f. flavigularis*) in captivity at Morogoro; skink (*Mabuya maculilabris*) at Mwaya; account of skink (*M. v. varia*) being chased at Mbanja; tail of skink (*Riopa sundevallii*) at Nchingidi.

Shrews (*Crocidura t. zaodon*) at Kitala; rat (*Rattus r. kijabius*) at Mangasini; rat (*Oenomys b. editus*) at Kaimosi; striped mouse (*Lemniscomys s. massaicus*) at Butandiga; pigmy mouse (*Leggada b. bella*) at Morogoro.

Parasites. Tick (*Aponomma falsolaeve*) at Morogoro (Bequaert). Nematodes (Kalicephalus sp) on White Nile (Leiper) and at Kitala, Mwanza and Mwaya; (*Physaloptera paradoxa*) at Kaimosi and Mwaya; (*Polydelphis quadricornis*) at Lumbo; (*Spiuroidea* ♀) at Mangasini and on Ukerewe Island. For account of snake dying from heavy infestation, see Loveridge (1923e, p. 887). Hemogregarines (*H. brendae*) at Entebbe (Pitman).

Enemies. Taken by a fishing eagle (*Haliaëtus v. vocifer*) in Sudan (Werner, 1908 (1907)); detailed account of the seizing of a sand-snake by another species of eagle at Morogoro, given by Loveridge (1928g); twice recovered from the stomachs of black-breasted harrier-eagles (*Circaetus g. pectoralis*), once from a common harrier-eagle (*C. cinereus*) and once from a cobra (*Naja n. nigricollis*) in Loveridge (1923e, etc.).

Habitat. In Egypt found only along the Nile and places irrigated by the Nile, as the Fayum and Delta, according to Flower (1933) whose paper should be consulted for details. Both in Egypt and in the Sudan he encountered it in gardens and cultivated areas.

In East Africa it is a species of the coastal plain to upland savanna (sea level to 7,000 feet), showing a preference for bush along water courses rather than for the eroded desert-like areas frequented by *P. subtaeniatus sudanensis.* On the other hand it avoids rain forest though it may be encountered on the outskirts.

Localities. **Algeria** (extreme south): Amguid; Atakor-n-Ahaggar; Djanet; Ideles, north of Hoggar; Tigen Davuo; Tirahart (Tigharghart) plateau; Tamrit. **Egypt:** Abbasa (Abbasiyeh); Abu Roash nr. Giza; Aswan (Assuan); Beltim; Cairo; Fayum; Giza; Luxor; Mehallet el Kebir (Mekalla el Kobra); Minia; Tel el Amarna. **Anglo-Egyptian**

Sudan: Barboi; Fazogli; Gabt el Meghahid; Gebel Debri; Kadugli; Khartoum; Khor Attar; Lul; Magangani; Sennar; Sururu; Tonga; Uma River to Khor River (Uma Khor); Um Orug; Wau. **Eritrea:** Adi Ugri; Anseba Valley; Barentu; *Chenafena; Cheren; Elaghim (Elaghin); Ghinda; Mai Mafeles (Mabellis); Maldi; Saganeita. **Ethiopia:** Arusi; Ado (Audo) Mountains; Daro Takle (Tacle); Gondar; Hawash (as Haccash); Sheik Hussein. **British Somaliland:** Inland of Berbera (Boulenger, 1896d); Las Gore, Warsingali (Ouarsangueilis. **Italian Somaliland:** Abdallah; Belet Amin; Duca degli Abruzzi; Kismayu and Mofi. **Uganda:** Ankole; Budongo Forest; Bundibugyo; Bussu; Butandiga; Butiaba; Entebbe; Gulu, Acholi; Jinja; Kampala; Katebo; Katunguru; Katwe; Kitala; Lake Kioga; Lira, Lango; Mount Debasien; Mount Elgon at 6,800 feet; Mabira Forest; Matema; Ongino; Rhino Camp; Semliki Valley; Serere; Sese (Ussi) Islands; Sipi; Ungora; Wadelai. **Kenya Colony:** Bissel; Bukori; Bura; Chyulu Hills; Eldoret; Fort Hall; Golbanti; Jilore; Juja Farm; Kaimosi; Kedong Valley; Kibwezi; Kilifi; Kitui; Kyambu; Machakos; Malindi; Mazeras; Mombasa; Mount Elgon; Mount Mbololo; Muddo Erelle (Pozzi Meddo Erelle); Nairobi; Nakuru; Ndi; Ngatana; Njoro; Peccetoni; Sokoki Forest; Taveta; Teita; Uasin Gishu; Voi; Witu. **Tanganyika Territory:** Amani; Amboni near Tanga; Arusha; Bagamoyo; Bukoba; Chanzuru; Dar es Salaam; Igale; Kagehi; Kerogwe; Kibwezi; Kidudu on Lungo River; Kilosa; Kitaya; Magasini; Matete Bach; Mbanja; Mikindani; Moshi; Mount Kilimanjaro; Mserere; Mwaya; Nchingidi; Pangani Falls; Pentambili; Sanya; Saranda; Shinyanga; Tanga; Tukuyu; Ujiji, Ukerewe Island; Unyanganyi; Wembere. **Zanzibar:** Kumbuni; Zanzibar. **Mozambique:** Beira; Boror; Cabaceira; Charre; Inhambane; Inhaminga; Matlale; Mbusi; Mesuril; Mgaza; Mozambique Island; Querimba Island; Quilimane; Rikatla; Tete; Xa Matlale. **Nyasaland:** Karonga to Kondowe; Masuku Mountains; Nkata Bay to Ruarwe; Shire Highlands; Zomba. **Northern Rhodesia:** Broken Hill; Feira district; Ikombo; Kazungula; Lealui (Lialui); Luangwa Valley; Mumbwa district; Munyamadzi River; Namwala district; Nyamkolo; Zom Store. **Southern Rhodesia:** Bulawayo; Gwamayaya River; Kafue River; Mashonaland; Mazoe; Salisbury; Swena's. **Bechuanaland Protectorate:** Gemsbok; Kabulabula; Kaotwe; Linokana; Makarikari; Maun; Mmoouve; Serowe; Shaleshonto; Shorobe. **Transvaal:** Comati and Crocodile Rivers; Irene; Kaapmuiden; Leysdorp; Louw's Creek; Lydenburg district; Mphome; Pretoria; Rustenburg district; Selati; Shilowane; Wonderboom. **Zululand:** Kosi Bay; Mseleni.

Natal: Durban (Port Natal); Greenwood Park; Lower Illovo; Pietermaritzburg; Pinetown; Umzumbe Valley. **Orange Free State:** Kroonstadt. **Cape Province:** Tulbagh. (Port Elizabeth record rejected). **South-West Africa:** Erongo Mountains; Gobabis; Hantam; Kamanyab; Luderitz Bay; Oshikango; Otjimbingue; Paderburn Farm. **Angola:** Ambriz; Caconda; Catumbela; Cazengo; Chitau; Cubal; Cuma; Duque de Braganca; Ebanga; Galanga; Hanha; Huila; Kalukembe (Caluquembe); Kakindo (Caquindo); Katenge (Catengue); Kayundo; Kuvanga; Loanda Island; Mossamedes; Mupa; Mupanda; Port Alexander; Pungo Adungo (Andongo); Quilengues; Quissangues; Rio Cuce; San Antonio; Vila da Ponte. **Cabinda:** Cabinda; Chinchoxo; Chingo. **Belgian Congo:** Abimoa; Albertville; Arebi; Avakubi; Banana; Banziville; Baudouinville; Beni; Boma; Bukama; Dika; Dilolo; Djalasinda; Dramba; Duma; Elisabethville; Faradje; Gabiro; Gandu; Garamba; Gatsibu; Kansenia; Kapiri; Kikondja; Kunungu; Lukafu; Mahagi Port; Mauda; Moanda; Monbuttu; Niangara; Nyonga; Povo Nemlao; Povo Netonna; Tembwe; Zambi. **French Equatorial Africa:** Abiras; Cape Lopez; Cette Cama (Sette Kama); Fernand Vaz; Fort Archimbault; Kusseri near Fort Lamy. **Nigeria:** Asaba; Lagos; Niger River mouth; Yola. **Dahomey:** Abomey; Agouagou; Cotonou. **Togoland:** Bismarckburg; Kantindi; Kete. **Gold Coast:** Ashanti; Oudmose; Peki. **French Guinea:** Kouroussa. **Portuguese Guinea:** Bissau; Bolama; Cacheu; Rio Cassini (Cassine). **Gambia:** MacCarthy Island. **Senegal:** Bakel; Dakar; Guenoto; Matam to Kaidi (Kaedi); Niani (Nianing); Rufisque. **French West Africa:** Bandiagara; Kati near Bamako; Mopti; Timbuktu.

Distribution. The typical form is found in suitable localities (see above) from Egypt to Natal on the east, while on the west it occurs from Mauretania to the Anglo-Egyptian Sudan (outside the forested areas occupied by *P. s. phillipsii*) south through the French and Belgian Congo to northern South-West Africa where it encounters several other races.

Psammophis sibilans phillipsii (Hallowell)

1844a. *Coluber Phillipsii* Hallowell, Proc. Acad. Nat. Sci. Philadelphia, p. 169: Liberia.

1854a. *Psammophis Phillipsii* Hallowell, Proc. Acad. Nat. Sci. Philadelphia, p. 100.

1857. Hallowell, Proc. Acad. Nat. Sci. Philadelphia, p. 69.

1860. Cope, Proc. Acad. Nat. Sci. Philadelphia, p. 554.

1885d. *Psammophis* sp. (*Phillipsii* Hall. ?) Müller, Verh. Naturf. Ges. Basel, **7**, p. 686.
1887b. *Psammophis sibilans* Mocquard (part, not Linné), Bull. Soc. Philom. Paris (7), **11**, p. 78.
1890. Buttikofer, Reisebilder aus Liberia, **2**, p. 478.
1901. Schenkel, Verh. Naturf. Ges. Basel, **13**, p. 172.
1902b. Mocquard, Bull. Mus. Paris, **8**, p. 415.
1902a. Werner, Verh. Zool. Bot. Ges. Wien, **52**, p. 338.
1906. Johnston, Liberia, **2**, p. 832.
1909. Gendré, Extr. Compt. Rendus in Actes Soc. Linn. Bordeaux, **63**, p. cvi.
1913. Klaptocz, Zool. Jahrb. Syst., **34**, p. 286.
1917. Sternfeld, Zweit. Deutschen Zent.-Afrika-Exped., **1**, pp. 409, 478.
1921a. Chabanaud, Bull. Com. Études Afrique Occ. Franç., p. 470.
1921b. Chabanaud, Bull. Mus. Paris, **27**, p. 525.
1922. Aylmer (part ?), Sierra Leone Studies, **5**, pp. 15, 21.
1925. Werner (part), 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1930a. Barbour & Loveridge, in Strong, Rep. Harvard-Afr. Exped. Liberia . . Congo, **2**, p. 773.
1893c. *Psammophis notosticta* Matschie (not Peters), Mitt. Fors. Gel. Deutsch Schutzgeb., **6**, p. 212.
1908a. *Psammophis regularis* Sternfeld, Mitt. Zool. Mus. Berlin, **3**, p. 412: Cameroon and Togo.
1908b. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, pp. 218, 233.
1909b. Sternfeld, Die Fauna Deutschen Kol., **1**, pt. 1, p. 21.
1916f. Chabanaud, Bull. Mus. Paris, **22**, p. 377.
1917b. Chabanaud, Bull. Mus. Paris, **23**, p. 12.
1921b. Angel (part), Bull. Mus. Paris, **27**, p. 141.
1919. *Psammophis sibilans* var. *occidentalis* Werner, Denks. Akad. Wiss. Wien, **96**, p. 504: Togo to Congo.
1938d. *Psammophis sibilans phillipsii* Loveridge, Proc. New Eng. Zoöl. Club, **17**, p. 59.

Synonymy. As Hallowell, in his original description of *phillipsii,* made no mention of the single anal, Boulenger (1896d, p. 161) very naturally placed it in the synonymy of *sibilans,* to which species most authors have referred their material though commenting on the single anal. It was this character which led Matschie (1893c, p. 212) to relegate a Togo specimen to *notostictus.* I now refer *regularis* and *occidentalis* to the synonymy of *phillipsii* though some doubt is entertained regarding this disposition of *occidentalis* as no type was designated, the name being proposed for a color form, and the author stating that he considered a single or divided anal of no taxonomic importance in this genus, which remark makes it appear possible that he included some typical *sibilans* material.

For further comments on the distribution of this race see *Remarks*.

Name. *Joppaguri* (Temne, Sierra Leone).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a quarter to once and a half as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than or equal to a supraocular, as long as or slightly longer or shorter than a parietal, much longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal once and two thirds to twice and a half as long as deep; preocular 1, separated from the frontal; postoculars 2, rarely 3; temporals 2 + 2 or 2 + 3 (3 + 2 *fide* F. Müller, 1885d, p. 686); upper labials 8, fourth and fifth entering the orbit; 4 lower labials in contact with the anterior sublinguals, which are as long as or shorter than the posterior. Midbody scales in 17 rows; ventrals 162–182; anal entire; subcaudals 89–109.

Coloration. Above, greenish olive or brown, uniform, or each scale edged with darker, rarely a vertebral line faintly indicated; head of young with pattern of typical *sibilans*, head of adults with conspicuous scattered black spots. Below, greenish or yellowish white, chin and throat spotted with black; belly uniform or punctate with each ventral shield transversely barred with black across its basal portion; tail uniform or each subcaudal shield with a black spot in its centre.

Sternfeld (1908b, p. 218) states that all eleven Togo snakes were uniform brown above and without stripes. Both uniform and speckled forms occur in Liberia.

Measurements. Largest ♂ measures 1350 (935 + 415) mm. from Monrovia, Liberia (M.C.Z. 913). Sternfeld's largest entire example measured 1320 (930 + 390) mm. and was from Togo.

Diet. Rodents (Sternfeld and Werner).

Habitat. Sternfeld's (1908a, p. 412) suggestion that *regularis* had a coastal distribution in Cameroon and Togo while typical *sibilans* occupied the hinterland, is applicable to *phillipsii* only to the extent that the latter's distribution coincides with that of the rain forest which is largely a broad belt from the French Congo to Liberia along the coast except for the area from Lagos to Accra where the dry conditions of the interior extend to the coast.

Localities. **French Equatorial Africa:** Fort Archambault; Gribingui region; Shari River. **French Congo:** Brazzaville. **French Cameroon:** Bipindi. **Dahomey:** Agouagou. **Togo:** Atakpame; Kete; Misahohe. **Ivory Coast. Liberia:** Ganta; Du River Plantation No. 3; Monrovia. **Sierra Leone. French Guinea:** Beyla;

Dieke; Dixine Foulah; Dubreka; Kerouane; Labe; Los Island; Macenta; Nzebela; Nzerekore.

Distribution. Rain-forest region from French Equatorial Africa to southern Nigeria, again from Dahomey to Sierra Leone where it meets with *P. s. sibilans* as at other points all along its northern limits. This apparently strange distribution can best be understood by reference to Meunier's map of Afrique Occidentale Française, 1925, showing the forested areas.

Remarks. It will be noted that this race as well as typical *P. s. sibilans* occur in the Gribingui region (Angel, 1921b, p. 141) as well as at Nzebela for one of the nine snakes from this locality had a divided anal. Though this was the only snake out of twenty-three which he collected in French Guinea that had a divided anal, Chabanaud (1921b, p. 525) referred all to *sibilans* (*sensu strictu*), and decided to synonymize *regularis* with *sibilans!*

Sternfeld's (1910a, p. 29) record of *regularis* as occurring at Amani, Usambara Mountains, Tanganyika Territory, while interesting, is referred to *P. s. sibilans*, the snake being regarded as aberrant.

Psammophis sibilans notostictus Peters

1858c. *Psammophis sibilans* Günther (part, not Linné), Cat. Snakes Brit. Mus., p. 136.
1887b. Boettger, Ber. Senckenberg. Ges., p. 159.
1867b. *Psammophis moniliger* var. *notostictus* Peters, Monatsb. Akad. Wiss. Berlin, p. 237: Otjimbingue, South-West Africa.
1869b. Peters, Ofver. Kongl. Vetensk.-Akad. Förh., p. 661.
1878. *Psammophis* sp. Müller, Verh. Naturf. Ges. Basel, **6**, pp. 610, 679.
1887a. *Psammophis sibilans* var. *stenocephalus* Bocage, Jorn. Sci. Lisboa, **11**, p. 205: Interior of Mossamedes, Angola.
1895a. Bocage, Herp. Angola Congo, p. 116.
1888b. *Psammophis sibilans* var. *notostictus* Fischer, Jahrb. Hamburg. Wiss. Anst., **5**, p. 12.
1894a. Boettger, Ber. Senckenberg. Ges., p. 91.
1895b. *Psammophis notostictus* Boulenger, Proc. Zool. Soc. London, p. 538.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 156.
1898. Sclater, Ann. S. African Mus., **1**, p. 100.
1901. Schenkel, Verh. Naturf. Ges. Basel, **13**, p. 172.
1903e. Boulenger, Ann. Mag. Nat. Hist. (7), **12**, p. 217.
1907c. Roux, Zool. Jahrb. Syst., **25**, p. 736.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 513.
1910b. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. 1, p. 26, fig. 29.
1910c. Sternfeld, Mitt. Zool. Mus. Berlin, **5**, p. 56.

1910a. Werner, Denks. Med. Nat. Ges. Jena, **16**, p. 360.
1911. Lampe, Jahrb. Nassau Verh. Naturk. Wiesbaden, **55**, p. 200.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 122, 123.
1912. Hewitt, Rec. Albany Mus., **2**, pp. 268, 270.
1913. Hewitt & Power, Trans. Roy. Soc. S. Africa, **3**, p. 163.
1914b. Methuen & Hewitt, Ann. Transvaal Mus., **4**, p. 144.
1915c. Werner, in Michaelsen, Beitr. Kennt. D.-Südwestafrikas, p. 364.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1929. Rose, Veld & Vlei, p. 163.
1935a. FitzSimons, V., Ann. Transvaal Mus., **15**, p. 522.
1935. Power, Proc. Zool. Soc. London, p. 334.
1936c. Parker, Novit. Zool., **40**, p. 125.
1937e. Hewitt, Guide Vert. Fauna E. Cape Prov., S. A. II, p. 63, fig. 1.
1937b. Monard, Arqu. Museu Bocage, Lisboa, **8**, p. 128.
1938. FitzSimons, V., Ann. Transvaal Mus., **19**, p. 158.
1915c. *Psammophis Leightoni* Werner (not Boulenger), in Michaelsen, Beitr. Kennt. D.-Südwestafrikas, p. 365, fig. 3 (but anal divided).

Synonymy. In addition to *stenocephalus*, the synonymy includes references to typical *sibilans* and Werner's (1915c, p. 365) Swakopmund snake with a divided anal which he referred to *leightoni*.

References to *notostictus* which are transferred elsewhere, include Matschie's (1893c, p. 212) Togo *P. s. phillipsii;* Sternfeld's (1910a, p. 29) Bagamoyo and Langenburg snakes; Loveridge's (1916a, p. 25 and 1924b, p. 6) to a skin without locality; Witte's (1933m, p. 93) from Albertville, etc., all of which are regarded as aberrant individuals of *P. s. sibilans*.

Names. Whip-Snake (English, South-West Africa, *fide* Hewitt).

Description. Rostral broader than deep, visible from above; snout once and a third to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as or slightly shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal once and a half to twice and a half as long as deep; preoculars 2, rarely 1, in contact with, rarely separated from, the frontal; postoculars 2, rarely 3; temporals 2 + 2 or 2 + 3, rarely 1 + 2 or 1 + 1; upper labials 8[1], fourth and fifth entering the orbit; 4 lower labials in contact with the anterior sublinguals, which are much shorter than the posterior. Midbody scales in 17 rows; ventrals 157–179; anal entire, rarely divided; subcaudals 81–106.

[1] Parker's (1936c, p. 125) Maltahöhe record with 9 upper labials, fourth, fifth and sixth entering the orbit, is aberrant and apparently not *sub. subtaeniatus*.

Coloration. Above, olive or pale sandy brown; head uniform or with light-centered dark spots in centre of each scale, pre- and post-oculars yellowish white as are also the upper labials of which the anterior are usually spotted with black; usually a black spot or pair of spots in the centre of each vertebral scale which is otherwise light colored and frequently forming a distinct, though fine, vertebral line; rarely an obsolescent indistinct light lateral stripe, with or without small black spots along its upper edge. Below, as well as the lower half of outer scale-row, white, yellowish, or olive, sometimes a well defined median yellow band down the centre; chin, throat and anterior ventrals often flecked with bluish gray or black.

Measurements. Largest ♂ measures 1366 (960 + 406) mm. from Namib Desert (M.C.Z. 43425); largest ♀ measures 865 (577 + 288) mm. from Luderitz Bay (Werner).

Diet. Lizards.

Habitat. Shows a preference for sandy soil; climbs trees to some extent (Hewitt). Uncommon on the Cape Peninsula where it is confined to the mountain apparently (Rose).

Localities. **Orange Free State:** Orange River; Smithfield. **Cape Province:** Alicedale; Beaufort West; Brakkloof; Burghersdorp; Caledon; Capetown; Ceres; Cradock; De Aar; Deelfontein; Driekoppen; Fauresmith; Fort Brown; Graff Reinet; near, but not at, Grahamstown; Hanover; Kakamas; Kleinpoort; Kuruman; Malmsbury division; Middleburg; O'okiep; 20 miles east of Port Nolloth; Robertson; Steinkop; Stellenbosch; Tafelberg; Touw's River; Victoria West. **South-West Africa:** Aus; Gobabis; Groendoorn; Hoffnung; Karas Mountains; Konya, Kalahari; Kubot; Kubub; Kuibis; Luderitz Bay; Maltahohe; Namib Desert; Narudas Sud; Okahandja; Orange River; Otjimbingue; Outgo; Prince of Wales Bay; Rietmond; Sandpund; Seeheim; Swakopmund; Tsaobis; Warmbad; Wasserfall. **Angola:** Mossamedes—interior; Rio Coroca; Rio San Nicolao.

Distribution. Southern Angola and South-West Africa to Cape Province. Records from Belgian Congo, Kenya, Tanganyika and Natal, are, as indicated under *Synonymy,* based on isolated, aberrant examples of *sibilans* possessing a single anal.

Psammophis sibilans trinasalis Werner

1867b. *Psammophis moniliger* var. *furcatus* Peters (not Bianconi), Monatsb. Akad. Wiss. Berlin, p. 236: Otjimbingue, South-West Africa.

1869b. Peters, Ofver. Kongl. Vetensk.-Akad. Förh., p. 661.

1886. *Psammophis sibilans* Boettger (not Linné), Ber. Senckenberg. Ges., p. 5.

1910b. Sternfeld (part), Die Fauna Deutschen Kol., **4**, pt. 1, p. 27, fig. 32.
1910c. Sternfeld (part), Mitt. Zool. Mus. Berlin, **5**, p. 56.
1888b. *Psammophis sibilans* var. *furcatus* Fischer (not Bianconi), Jahrb. Hamburg. Wiss. Anst., **5**, p. 12.
1894a. Boettger, Ber. Senckenberg. Ges., p. 91.
1937e. Mertens, Ver. Deutschen Kol.-Übersee Mus. Bremen, **2**, p. 15.
1895b. *Psammophis furcatus* Boulenger (not Bianconi), Proc. Zool. Soc. London, p. 538.
1896d. Boulenger (part), Cat. Snakes, Brit. Mus., **3**, p. 164.
1898. Sclater, Ann. S. African Mus., **1**, p. 100.
1902. Lampe & Lindholm, Jahrb. Nassau Verh. Naturk. Wiesbaden, **55**, p. 59.
1908. Gough, Ann. Transvaal Mus., **1**, p. 29.
1909d. Werner, Jahrb. Hamburg. Wiss. Anst., **26**, p. 247.
1910b. Boulenger (part), Ann. S. African Mus., **5**, p. 513.
1910a. Hewitt, Ann. Transvaal Mus., **2**, p. 57.
1910a. Werner (part), Denks. Med. Nat. Ges. Jena, **16**, p. 361.
1911. Lampe, Jahrb. Nassau Verh. Naturk. Wiesbaden, **64**, p. 201.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 122, 123.
1912. Hewitt (part), Rec. Albany Mus., **2**, p. 269.
1913. Hewitt & Power, Trans. Roy. Soc. S. Africa, **3**, p. 163.
1915c. Werner, in Michaelsen, Beitr. Kennt. D,-Südwestafrikas, p. 365.
1918. Power, S. African Journ. Sci., **14**, p. 268.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A., p. 141.
1935b. FitzSimons, V., Ann. Transvaal Mus., **16**, p. 316.
1938. FitzSimons, V. (part), Ann. Transvaal Mus., **19**, p. 157.
1902a. *Psammophis sibilans trinasalis* Werner, Verh. Zool. Bot. Ges. Wien, **52**, p. 340: Windhuk, South-West Africa.
1903. *Psammophis trinasalis* Werner, Abh. Bayer. Akad. Wiss., **22**, p. 381

Synonymy. In addition to references to *sibilans,* the majority applicable to this form have appeared under the name of *furcatus* Peters, raised to specific rank by Boulenger (1896d, p. 538). Most unfortunately, however, this name is preoccupied by *Dendrophis furcata* Bianconi, 1859, which is a synonym of *Psammophis punctulatus punctulatus* Duméril & Bibron.

The next name available is that of *trinasalis* Werner, raised to specific rank by its author in 1903. Actually all western forms of *sibilans* exhibit a distinct tendency towards the possession of three nasal shields as opposed to the two normally found in typical *sibilans* on the eastern side of the continent; the character is far too variable to have much value.

Chabanaud's (1918b and 1921a) "*trinasalis*" from Senegal are referred to *P. s. schokari.*

Description. Rostral broader than or as broad as deep, visible from above; snout once and a half to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as or longer than a parietal, longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal once and a quarter to twice as long as deep; preocular 1, rarely 2, broadly in contact with, rarely separated from[1], the frontal; postoculars 2, rarely 3; temporals 2 + 2 or 2 + 3; upper labials 8, fourth and fifth entering the orbit; 4 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 17 rows; ventrals 152–180; anal divided; subcaudals 85–117.

Coloration. Above, olive or pale brown, each scale edged or tipped with black; head with a light line from the rostral to the frontal and a pair of light lines extending along the fronto-supraocular suture posteriorly across the parietals, pre- and postoculars yellowish white as are also the upper labials; a transverse black spot or pair of spots in the centre of each vertebral scale which is otherwise light colored and frequently forming a distinct, though fine, vertebral line; a distinct light lateral stripe, edged above, and sometimes below also, with black. Below, as well as lower half of outer scale-row, white, yellowish, or olive; sometimes a well defined median yellow band down the centre; chin, throat, and anterior ventrals often flecked or streaked with bluish gray or black, the latter sometimes forming a pair of longitudinal lines which unite upon the throat.

Measurements. Largest ♀ measures 1030 (690 + 340) mm. from Erongo Mountain plateau, South-West Africa (M.C.Z. 43423).

Diet. A gecko (*Ptenopus garrulus*), agama (*Agama h. aculeata*), lizards (*Eremias lugubris, Scapteira depressa*) and skink (*Mabuya* sp.) have been recorded by Werner.

Parasites. Nematodes.

Habitat. Sometimes found in thorn trees (*Acacia horrida*) and hibernating in abandoned termitaria.

Localities. **Transvaal:** Daspoort; Pretoria. **Bechuanaland Protectorate:** Kaotwe; Kuke; Sunnyside to Gemsbok. [2]**Cape Province:** Aughrabies; Burghersdorp; Gordonia; Kimberly; Kgokong to Kong; Madibi; Nosob River; Rietfontein; Springbok Vlei; Vryburg. **South-**

[1] Separated in a Pretoria snake *fide* Hewitt (1912, p. 269).

[2] Hewitt (1912, p. 269) rightly rejects the Port Elizabeth record of F. W. FitzSimons as erroneous; if correctly identified then the possibility of its being an escaped individual should be considered.

West Africa: Areb near Maltahohe; Aus to Bethanien; Berseba; Gibeon; Kalahari; Keetmanshoop; Kraaiwater; Kubub-Sinclair Mine; Luderitz Bay; Namib Desert; Okahandja; Okosongomingo Farm; Ovamboland; Omaruru; Onambeke; Otjikondo; Otjimbingue; Rehoboth; Rietmond; Rooibank; Windhuk.

Distribution. Transvaal, Bechuanaland Protectorate, and adjacent northeastern Cape Province to South-West Africa.

Psammophis sibilans leightoni Boulenger

1887b. *Psammophis sibilans* Boettger (part, not Linné), Ber. Senckenberg. Ges., p. 159.
1902a. *Psammophis leightoni* Boulenger, Proc. Zool. Soc. London, **1**, p. 126, pl. xii: Eerste River Station, Cape Province, Union of S. Africa.
1908. Gough, Ann. Transvaal Mus., **1**, p. 29.
1907c. *Psammophis furcatus* Roux (not Bianconi), Zool. Jahrb. Syst., **25**, p. 738.
1910b. Boulenger (part), Ann. S. African Mus., **5**, p. 513.
1910a. Werner (part), Denks. Med. Nat. Ges. Jena, **16**, p. 361.
1912. Hewitt (part), Rec. Albany Mus., **2**, p. 269.
1936h. Loveridge, Field Mus. Nat. Hist. Zool. Ser., **22**, p. 38.
1938. FitzSimons, V. (part), Ann. Transvaal Mus., **19**, p. 157.

Synonymy. This extreme southern race has been confused with *sibilans* and with *furcatus* Peters (not of Bianconi), here called *P. s. trinasalis,* from which it differs solely in the light transverse, instead of longitudinal, lines upon the head, and probably in a lower average ventral count.

Should the differences in marking prove untenable, then *leightoni* would take precedence over *trinasalis* and the two have to be merged. Recognition of *leightoni* appears logical in view of what we already know of the differentiation of forms in the Cape Peninsula and adjacent region.

Werner's (1915c, p. 365, pl. vii, figs. 3–3a) Swakopmund snake which he refers to *leightoni* has the coloring of *notostictus* with the divided anal of *trinasalis,* I tentatively refer it to the former which occasionally may have a divided anal.

Description. As in *P. s. trinasalis* except for two unimportant variations, *i.e.* the frontal is slightly shorter than a parietal, the loreal twice as long as deep. Scale-counts are: nostril between 2 or 3 shields; preocular 1; postoculars 2; temporals 2 + 2 or 2 + 3, rarely 1 + 2; upper labials 8, fourth and fifth entering the orbit; 4 lower labials in

contact with the anterior sublinguals. Midbody scales in 17 rows; ventrals 156–176; anal divided; subcaudals 84–110.

Coloration. Above, dark brown; rostral and labials yellow spotted with black, a light (yellow) line from the rostral to the frontal, a pair of light lines along the fronto-supraocular sutures, two pairs of light spots on the parietals, four yellow bars on each side of the head, the first on the preocular, the second on the postoculars, the third extending to the upper surface of the head to unite, or nearly unite, with its fellow on the occiput, sides of neck with dark ocelli edged with bright yellow.

Body coloring substantially similar to that described for *trinasalis* and excellently figured on Boulenger's plate xii.

Measurements. Largest ♀ measures 1065 (700 + 365) mm. Steinkop, Little Namaqualand (Werner).

Localities. **Cape Province:** Capetown; Eerste River Station; Jakalswater to Orange River; Kleinzee; Malmsbury; Port Nolloth and 20 miles north; Steinkop; Stellenbosch.

Distribution. Cape Province from western Little Namaqualand to the Cape Peninsula.

Psammophis subtaeniatus sudanensis Werner

1884a. *Psammophis sibilans subtaeniata* Fischer (not Peters), Jahr. Hamburg. Wiss. Anst., **1**, p. 12.
1891a. Boulenger, Proc. Zool. Soc. London, p. 307.
1888. *Psammophis sibilans* Mocquard (not Linné), Mém. Soc. Philom. Cent. Paris, p. 130.
1893b. Stejneger, Proc. U. S. Nat. Mus., **16**, p. 731.
1910. Meek, Field Mus. Nat. Hist. Zool. Ser., **7**, p. 405.
1895b. *Psammophis subtaeniatus* Boulenger (part), Proc. Zool. Soc. London, p. 538.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 160.
1896. Tornier, Kriechthiere Deutsch-Ost-Afrikas, p. 82.
1897e. Boulenger, Proc. Zool. Soc. London, p. 801.
1897. Tornier, Arch. Naturg., **63**, **1**, p. 65.
1898. Johnston, British Cent. Africa, p. 361a.
1898. Tornier, in Werther, Mitt. Höch. Deutsch-Ost-Afrika, p. 297.
1902b. Mocquard, Bull. Mus. Paris, **8**, p. 406.
1907. Lönnberg, in Sjöstedt, Wiss. Ergeb. Zool. Exped. Kiliman., p. 16.
1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, pp. 241, 244.
1908a. Werner, Third Rep. Wellcome Res. Lab. Khartoum, p. 171.
1910a. Sternfeld, Die Fauna Deutschen Kol., **3**, pt. 2, p. 30, fig. 33.
1911a. Sternfeld, Sitz. Ges. Naturf. Freunde Berlin, p. 250.

1913. Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 364.
1915c. Boulenger, Proc. Zool. Soc. London, p. 631.
1916a. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc., **5**, p. 85.
?1918. [1]Calabresi, Mon. Zool. Ital. Firenze, **29**, p. 124.
1918a. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc., No. 13, p. 327.
1919. Werner, Denks. Akad. Wiss. Wien, **96**, p. 504.
1923e. Loveridge, Proc. Zool. Soc. London, p. 884.
1924b. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc. Supp. 3, p. 6.
1925a. Angel, in Voyage Alluaud et Jeannel Afrique Orient., **2**, p. 35.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1928d. Loveridge, Proc. U. S. Nat. Mus., **73**, Art. 17, p. 55.
1928g. Loveridge, Bull. Antivenin Inst. America, **2**, p. 36.
1929h. Loveridge, Bull. U. S. Nat. Mus. No. 151, p. 32.
1933h. Loveridge (part), Bull. Mus. Comp. Zoöl., **74**, p. 254.
1935a. Corkhill, Sudan Govt. Mus. Publ. No. 3, p. 22.
1935. Cunha, Mem. Estudos Mus. Zool. Univ. Coimbra (1), No. 83, p. 9.
1936h. Loveridge, Field Mus. Nat. Hist. Zool. Ser. **22**, p. 38.
1936j. Loveridge, Bull. Mus Comp. Zoöl., **79**, p. 263.
1936. Roux, in Jeannel, Miss. Scient. de l'Omo, **3**, p. 177.
1937f. Loveridge, Bull. Mus. Comp. Zoöl., **79**, pp. 493, 496.
1937. Pitman (part), Uganda Journ., **4**, p. 230, pl. xi, fig. 2, col. pl. K, fig. 2.
1937. Uthmöller, Temminckia, **11**, p. 119.
1938. Pitman (part), Uganda Journ., **5**, pp. 215, 233.
1939c. Scortecci, Gli Ofidi Velenosi dell' Africa Italiana, p. 150.
1919. *Psammophis subtaeniatus* var. *sudanensis* Werner, Denks. Akad. Wiss. Wien, **96**, p. 504: Kadugli, Anglo-Egyptian Sudan (designated).

Synonymy. As explained under the typical form, *P. subtaeniatus* of Boulenger's Catalogue (1896d, p. 160) is a composite of two forms, typical *subtaeniatus* with 9 upper labials of which the fourth, fifth and sixth enter the orbit, ranging south of the Zambesi, and the present race occurring from Zambezia to the southern Sudan. The latter is constant in having only 8 upper labials of which the fourth and fifth only enter the orbit. Heretofore this common East African snake has been almost consistently designated *subtaeniatus.*

This is really the reptile which Mertens (1937b, p. 14) had in mind when he decided to synonymize *subtaeniatus* with *sibilans.* I have the deepest sympathy with such action in view of the fact that there are no scale characters on which I have been able to separate *sudanensis* from typical *sibilans.* Neither can one treat *sudanensis* as a race of *sibilans* for they occur together in many localities in East Africa the

[1] Data omitted as apparently a misidentification.

more slender *sudanensis* favouring arid localities and the more robust *sibilans* the river banks and cultivated lands adjacent to the eroded areas.

Werner (1919, p. 504) endeavours to distinguish between Sudanese (*sudanensis*) and East African specimens (which he calls *subtaeniatus*), but this does not appear possible. Under the circumstances his name *sudanensis* becomes available for both. As no type was designated, the Kadugli snake, which he describes in some detail, is to be regarded as the type.

Names. Northern Stripe-bellied Sand-Snake (English); according to Corkhill, *abu sa aifa* (Arabic, Sudan, also applied to *P. sibilans schokari*); *dowa* (Nubas of Um Gabrallah); *inimaro* (Nubas of Toitcho); *kalingi* (Nubas of Turun); *narangi* (Nubas of Tira Luman; *peritoro* (Nubas of Acheron); *rungu* (Nubas of Kinderma); according to Loveridge, *mbalama* (Yeye, Shinyanga); *iruwassi* (Nyamwezi, Tabora); *mlalu* (Gogo, Dodoma); *sangaraza* (Kami, Morogoro and Swahili, Coast); *mchezawanawake* (Amu, Lamu); *naru* (Makonde and Mahiwa).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a half to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than or equal to a supraocular, as long as or slightly longer or slightly shorter than a parietal, as long as or usually longer than its distance from the end of the snout; nostril between 2, very rarely 3, shields; loreal twice to twice and a half as long as deep; preocular 1, rarely 2, separated from, rarely in contact with, the frontal; postoculars 2; temporals 2 + 2 or 2 + 3, rarely 1 + 2; upper labials 8, fourth and fifth entering the orbit; 4, very rarely 5, lower labials in contact with the anterior sublinguals, which are as long as or shorter than the posterior. Midbody scales in 17 rows; ventrals 148–169; anal divided; subcaudals 92–114.

Coloration. Above brown or olive; a light vertical line from the tip of the snout across the rostral to the posterior end of the frontal where it meets with the first of three light transverse stripes of which the hindmost is just behind the parietals; a black line across the rostral is continued along the upper border of the upper labials which are yellowish, with or without black spots; dorsum with or without a fine yellow vertebral line, usually the seven middle dorsal scale-rows darker, edged with black, and separated from the sides by a pair of more or less distinct pale longitudinal stripes. Below, a band of bright yellow down the centre of the ventrals flanked on either side by a sharply defined black line which separates it from the usually paler

or white band occupying the outer edges of the ventrals and the lower half of the outer scale-row, this coloration continued at least on to anterior part of tail.

Measurements. Largest ♀ measures 1300 (938 + 362) mm. from Budongo Forest, Uganda (Pitman). Largest ♂ measures 1263 (863 + 400) mm. and ♀ measures 1161 (777 + 384) mm., both from Morogoro, Tanganyika Territory (Loveridge).

Breeding. For a possible courtship practice, see Loveridge (1928g, p. 36).

Oviducts of a series of Morogoro snakes were examined and appeared to support the assumption that the number of eggs produced is governed to some extent by the dimensions of the mother. Thus

on September 23rd 10 eggs were found in a 45-inch female,
on October 22nd 8 eggs were found in a 39-inch female,
on October 22nd 7 eggs were found in a 27-inch female,
on October 22nd 6 eggs were found in a 28-inch female.

On the same day, October 22nd, 6 eggs, measuring 32 x 13 mm. were laid by yet another *sudanensis.*

On December 10th and January 1st sixteen newly hatched young were caught. One of these was in a heap of rubbish; in their convulsive efforts to escape two of these snakelings actually *leapt off the ground.*

Diet. Detailed accounts of feeding habits have been given (Loveridge, 1928g, p. 36) and an incident recorded where a stripe-bellied sand-snake was apparently lying in wait for small weaver birds (*Lagnosticta*). That they will take small birds such as a warbler (*Prinia m. tenella*) in captivity is certain, though their principal food is undoubtedly lizards such as geckos (*Hemidactylus mabouia*) and striped skinks (*Mabuya striata*) at Morogoro, a variable skink (*M. v. varia*) at Mikindani, and a frog (*Rana edulis*) at Mkonumbi; frogs (*Arthroleptis s. stenodactylus*) at Mikindani. According to Uthmöller, mice and chameleons are also taken.

Parasites. Worms of many species (*Ascaris* sp., *Oochoristica crassiceps, Ophidascaris mombassica, Physaloptera affinis*) have been recovered from the alimentary tracts.

Enemies. Five from stomachs of eagles (*Circaëtus cinereus*) at Amboni and Mikindani.

Temperament. Bite freely when first captured though not as savagely as does the hissing sand-snake.

Venom. The bite is apparently harmless to man as I have been bitten several times without any ill effects. See also account of native being bitten (Loveridge, 1928g, p. 37).

Habitat. The northern stripe-bellied sand-snake shows a preference for dry savanna with scattered bush; being an adept climber it suns itself among the twigs and in such a situation is difficult to detect as it harmonises so well with its environment. A snake disturbed in thorn-bush country, flashed across the path and was twenty feet up in the topmost twigs of a stunted tree in a matter of moments. Several were taken in the thatches of native huts where they had gone in search of lizards.

Localities. **Anglo-Egyptian Sudan:** Jebel Moro; Kadugli; Mnyouri Jardin; Wau. **Ethiopia:** Bodessa. **Uganda:** Katwe; Mount Debasien. **Kenya Colony:** Athi Plains; Bura; Changamwe; Frere Town; Guaso Nyiro; Kibwezi; Lamu Island; Lolokwi Mountain; Mkonumbi; Mombasa; Nanoropus; Lake Rudolf; Takaungu; Tana River; Ulukenya Hills; Voi; Wange; Witu. **Tanganyika Territory:** Amboni near Tanga; Arusha; Chanzuru; Dakawa; Dar es Salaam; Dodoma; Gomberi; Ilonga; Kideti; Kilimanjaro Mountain; Kilosa; Kimamba; Kitaya; Kitopeni; Lalago; Lukigura; Marungu; Masai nyika; Mavene; Mbanja; Mikindani; Mkata Station; Mkindo; Moshi; Mtali's village; Mwanza; Nchingidi; Ngare na nyuki; Njiri swamp; Nyambita; Pangani; Sagayo; Sanga; Sekenke; Suna; Tabora; Tukuyu; Ubamba Bay; Usandawi; Ushora; Wembere. **Zanzibar:** Zanzibar. **Mozambique:** Lumbo; Massangulo. **Nyasaland:** Cape McClear; Lake Nyasa; Masuku Mountains; Nkata Bay to Ruarwe; Nyika Plateau; Zomba.

Distribution. Drier regions of the southern Sudan and Uganda east through southern Ethiopia and northern Kenya, south through Tanganyika to Nyasaland and northern Mozambique. It occurs from sea level allegedly to 6,000 feet in Nyasaland according to Boulenger.

Remarks. Mocquard's (1896, p. 45) record from Abiras, upper Ubangi, is probably a stripe-bellied example of *sibilans* such as are not uncommon in the French Sudan.

The single record of *subtaeniatus* from Italian Somaliland (Calabresi, 1918, p. 124) based on a young snake measuring 230 (170 + 60) mm. with only 143 ventrals and 70 subcaudals, is rejected pending confirmation, and these counts omitted from the range given in the description.

Sternfeld's (1912c, p. 273) Ukerewe Island record, as well as those of Loveridge (1933h, p. 254) from this and other localities, with the exception of Mwanza and part of the Usandawi series, listed in that paper, are now considered to be stripe-bellied *sibilans* and their length and dietic records in this reference are transferred to *P. s. sibilans.*

Werner (1925(1924), p. 140) includes Katanga in the range of "*subtaeniatus*" but I have failed to trace the record of any material on which the extension in range is based.

PSAMMOPHIS SUBTAENIATUS SUBTAENIATUS Peters

1854. *Psammophis moniliger* Peters (part, not Daudin), Monatsb. Akad. Wiss. Berlin, p. 623.
1855. Peters, Arch. Naturg., **21**, **1**, p. 53.
1881b. *Psammophis brevirostris* Peters (part), Sitz. Ges. Naturf. Freunde Berlin, p. 89.
1882a. *Psammophis sibilans* var. *subtaeniata* Peters, Reise nach Mossambique, **3**, p. 121: Borer and Tete, Mozambique.
1895a. Bocage, Herp. Angola Congo, p. 116.
1887b. *Psammophis sibilans* Boettger (part, not Linné), Ber. Senckenberg. Ges., p. 159.
1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, p. 246.
1931. Power (part), Trans. Roy. Soc. S. Africa, **20**, p. 43.
1937b. Mertens, Abh. Senckenberg. Naturf. Ges. No. 435, p. 14.
1895b. *Psammophis subtaeniatus* Boulenger (part), Proc. Zool. Soc. London, p. 538.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 160.
1896a. Bocage, Jorn. Sci. Lisboa (2), **4**, p. 93.
1902a. Werner, Verh. Zool. Bot. Ges. Wien, **52**, p. 340.
1909. Chubb, Proc. Zool. Soc. London, p. 596.
1912. Hewitt, Rec. Albany Mus., **2**, p. 273.
1913. Hewitt & Power, Trans. Roy. Soc. S. Africa, **3**, p. 164.
1915c. Boulenger (part), Proc. Zool. Soc. London, p. 631.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1927c. Power, Trans. Roy. Soc. S. Africa, **14**, p. 409.
1928. Cott, Proc. Zool. Soc. London, p. 953.
1931. Power, Trans. Roy. Soc. S. Africa, **20**, p. 48.
1935. Cott, 1934, Proc. Zool. Soc. London, p. 968.
1935b. FitzSimons, V., Ann. Transvaal Mus., **16**, p. 317.
1939b. FitzSimons, V., Ann. Transvaal Mus., **20**, p. 23.
1895b. *Psammophis bocagii* Boulenger, Proc. Zool. Soc. London, p. 538: Angola (Later stated to be Benguela, Angola).
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 161, pl. viii, fig. 1.
1897a. Bocage, Jorn. Sci. Lisboa (2), **4**, p. 201.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 514.
1910b. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. 1, p. 27, fig. 31.
1910c. Sternfeld, Mitt. Zool. Mus. Berlin, **5**, p. 56.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 123, 124.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.
1936c. Parker, Novit. Zool., **40**, p. 126.

1937b. Monard, Arqu. Museu Bocage, Lisboa, **8**, pp. 128, 131.
1938. FitzSimons, V., Ann. Transvaal Mus., **19**, p. 157.
1908. *Psammophis transvaalensis* Gough, Ann. Transvaal Mus., **1**, p. 31, figs.: Louw's Creek, Transvaal.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 513.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 123, 124.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 140.

Synonymy. It appears probable that part of the material on which Peters' (1881b, p. 89) based his *brevirostris* is referable to *subtaeniatus*. The typical form has also been listed under *moniliger* and *sibilans*, while a few of the references to *subtaeniatus* in the literature really refer to *sibilans*.

Names. Southern Stripe-bellied Sand Snake (English); according to Peters, *nemoviri* (at Boror); *njammarumba* or *njamudsarumba* (at Tete); according to Bocage, *bandangila* (at Caconda), *lubis* (on Rio Bengo).

Description. Rostral broader than or as broad as deep, visible from above; snout once and a half to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than or equal to a supraocular, as long as or slightly longer or slightly shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 or 3 shields; loreal twice to twice and a half as long as deep; preocular 1 or 2, separated from or in contact with the frontal; postoculars 2, rarely 3[1]; temporals 2 + 2 or 2 + 3, rarely 1 + 2; upper labials 9, rarely 8 or 10, fourth, fifth, and sixth, rarely fourth and fifth or fifth, sixth and seventh, entering the orbit; 4, very rarely 5, lower labials in contact with the anterior sublinguals, which are as long as or shorter than the posterior. Midbody scales in 17 rows; ventrals 159–174; anal[2] divided; subcaudals 109–127 (Peter's type with 54 must have had a truncated tail).

Coloration. Above, olive to olive brown, paler posteriorly, the seven middle dorsal rows dark-edged and forming a broad black-edged dorsal band, separated from the sides by a more or less distinct creamy or yellowish brown stripe on the posterior four-fifths of body and continued on tail; sides brown, usually a black lateral streak along the middle of the outer row of scales; upper labials yellowish with or without black dots, a black line along their upper border which is continued across the rostral; head with markings of the eastern race more or less faintly visible. Below, chalky yellow, a sharply distinct fine black line

[1] Fide FitzSimons, 1938, p. 157.
[2] Rarely entire, i.e. in Maltahohe snake in British Museum.

along each side of the belly and anterior part of tail separating the yellow centre from the white outer portion of the ventrals.

Measurements. Largest ♂ measures 1110 (735 + 375) mm.; largest ♀ measures 995 (625 + 350) mm. Both from Bechuanaland Protectorate (FitzSimons, 1935b, p. 317). Largest unsexed specimen 1470 (1080 + 390) mm. from Mupanda, Angola (Monard, 1937b, p. 132).

Diet. Lizard (*Agama h. armata*) *fide* Cott; and a frog, according to Power.

Localities. **Mozambique:** Boror; Caia; Fambani; Inhaminga; Mgaza; Tete; Xa Matlale. **Southern Rhodesia:** Birchenough Bridge; Bulawayo; Matopos; Victoria Falls. **Bechuanaland Protectorate:** Francistown; Gemsbok to Sunnyside; Lobatsi; Lupani; Mabeleapudi; Makarikari; Maun; Moove. **Transvaal:** Louw's Creek; Nelspruit; Njelele River. **South West Africa:** Gobabis; Grootfontein; Namib Desert; Oshikango; Waterberg; Otjosangombe; Outgo; Windhoek. **Angola:** Benguela; Bibala; Catumbela; Cunene; Forte Roçadas; Humbe; Maconjo; Mulondo; Mapa; Mupanda; Rio Bengo.

Distribution. Drier regions of southern Mozambique west to South-West Africa and southern Angola.

Remarks. One of Peters' (1881b, p. 89) types of *brevirostris* had 9 upper labials, the fourth, fifth and sixth entering the orbit, characteristic of *subtaeniatus* (*sensu strictu*) and so is transferred here.

The *Psammophis subtaeniatus* of Boulenger's (1896d, p. 160) Catalogue is a composite of true *subtaeniatus* and a form found north of the Zambesi to which all his material apparently belonged. The northern race is characterised by having, like *sibilans*, only 8 upper labials, fourth and fifth entering the orbit, for this form Werner's name of *P. subtaeniatus sudanensis* is the first available.

Hewitt (1912, p. 273) was the first to point out that *bocagii* and *transvaaliensis* were synonymous with *subtaeniatus* of Peters, but did not realise that *subtaeniatus* of Boulenger was a composite.

Psammophis biseriatus tanganicus subsp. nov.

1888. *Psammophis biseriatus* Mocquard (not Peters), Mém. Soc. Philom. Cent. Paris, p. 130.
1890b. Boulenger, Ann. Mag. Nat. Hist. (6), **6**, p. 93.
1892. Boulenger, 1891, Ann. Mus. Genova (2), **12**, p. 15.
1893b. Boettger, Zool. Anz., **16**, pp. 119, 123.
1895b. Boulenger, Proc. Zool. Soc. London, p. 537.

1895g. Boulenger, Ann. Mag. Nat. Hist. (6), **16**, p. 168.
1896b. Boulenger, Ann. Mus. Genova (2), **17**, p. 13.
1896d. Boulenger (part), Cat. Snakes Brit. Mus., **3**, p. 168.
1896e. Boulenger, Proc. Zool. Soc. London, p. 216.
1896. Tornier (part), Kriechthiere Deutsch-Ost-Afrikas, p. 82.
1897g. Boulenger, Ann. Mus. Genova (2), **17**, p. 279.
1897. Tornier (part), Arch. Naturg., **63**, **1**, p. 65.
1898. Tornier (part), in Werther, Mitt. Höch. D.-Ost-Afrikas, p. **297**.
1901a. Boulenger, Proc. Zool. Soc. London, p. 49.
1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, p. 241.
1908. Werner, 1907, Sitz. Akad. Wiss. Wien, **116**, **1**, p. 1878.
1909c. Boulenger, Ann. Mus. Genova (3), **4**, p. 309.
1909d. Boulenger, Ann. Mus. Genova (3), **4**, p. 311.
1912b. Boulenger, Ann. Mus. Genova (3), **5**, p. 332.
1912b. Sternfeld, Sitz. Ges. Naturf. Freunde Berlin, p. 385.
1913. Lönnberg & Andersson, Ark. Zool., **8**, No. 20, p. 4.
1915c. Boulenger (part), Proc. Zool. Soc. London, p. 631.
1915d. Boulenger (part), Proc. Zool. Soc. London, p. 653.
1916. Calabresi, Mon. Zool. Ital. Firenze, **27**, p. 41.
1923e. Loveridge, Proc. Zool. Soc. London, p. 887.
1924b. Loveridge (part), Journ, E. A. Uga. Nat. Hist. Soc. Supp. **3**, p. **6**.
1925. Werner (part), 1924, Arch. Naturg., **96**, Abt. A, p. 141.
1927. Calabresi, Atti. Soc. Ital. Sci. Nat., **66**, pp. 33, 55.
1928d. Loveridge, Proc. U. S. Nat. Mus., **73**, Art. 17, p. 56.
1928g. Loveridge (part), Bull. Antivenin Inst. America, **2**, p. 40.
1929c. Scortecci, Atti. Soc. Ital. Sci. Nat., **68**, p. 278.
1930a. Scortecci, Atti. Soc. Ital. Sci. Nat., **69**, p. 213.
1930. Vinciguerra, Ann. Mus. Genova, **50**, p. 41.
1930b. Zavattari, in Bono, Miss. Sci. Eritrea, p. 194.
1931c. Scortecci, Atti. Soc. Ital. Sci. Nat., **70**, p. 210.
1932. Gestro & Vinciguerra, in Abruzzi, Esplor.-Uebi Scebeli, p. **500**.
1932b. Parker, Proc. Zool. Soc. London, p. 364.
1933h. Loveridge, Bull. Mus. Comp. Zoöl., **74**, p. 256.
1934a. Scortecci, Natura (Milano), **25**, p. 62, fig. 25.
1935a. Corkhill, Sudan Govt. Mus. Publ. No. 3, p. 21.
1936h. Loveridge (part), Field Mus. Nat. Hist. Zool. Ser., **22**, p. 39.
1937f. Loveridge (part), Bull. Mus. Comp. Zoöl., **79**, pp. 493, 496.
1937. Pitman (part), Uganda Journ., **4**, p. 240, pl. xi, fig. 3, pl. K, fig. 3.
1937a. Scortecci, Atti. Soc. Ital. Sci. Nat., **76**, p. 174, pl. v, fig. 4.
1937. Zavattari, in Festschrift Geburt Embrik Strand, **2**, p. 532.
1939a. Scortecci (part), Ann. Mus. Genova, **63**, p. 281 (Hafun only).
1939c. Scortecci (part), Gli Ofidi Velenosi dell'Africa Italiana, p. 145, figs. 78–79.

1897. *Psammophis sibilans* Meek (not Linné), Field Mus. Nat. Hist. Zool. Ser., **1**, p. 179.

Synonymy. The majority of the references to the typical form in the literature refer to this race.

Names. Link-marked Sand-Snake or Two-striped Sand-Snake (English); *subhainyu* (Somali); *kitlaku* (Sandawi); *zokalugwagu* (Gogo).

Type. Museum of Comparative Zoölogy, No. 30380, A half-grown ♀ from Mangasini, Usandawi, central Tanganyika Territory, collected by Arthur Loveridge, December 12, 1929.

Paratypes. Twenty specimens in the Museum of Comparative Zoölogy from Dodoma, Ikikuyu, Kikuyu, Kilimatinde, Mangasini and Usandawi, all in the Central Province, Tanganyika Territory.

Description of type. Midbody scales in 15 rows; ventrals 151; anal divided; subcaudals 114; preocular 1; postoculars 2; labials 9, the fourth, fifth and sixth entering the orbit. It is this last character alone which separates this form from the typical race.

Description. Rostral broader[1] than deep, visible from above; snout once and a third to once and two thirds[2] as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as or slightly shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 shields; loreal twice to thrice[3] as long as deep; preocular 1, rarely 2, broadly, rarely narrowly, in contact with the frontal; postoculars 2; temporals 2 + 2 or 2 + 3, rarely 1 + 2 or 1 + 3; upper labials 9, rarely 8 or 10, fourth, fifth and sixth, rarely third, fourth and fifth, entering the orbit; 5 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 15 rows; ventrals 142–168; anal divided; subcaudals 97–117.

Coloration. As in the typical form.

Measurements. Largest ♀ measures 865 (565 + 300) mm. from Mangasini, Tanganyika Territory (Loveridge).

Breeding. Young snakes 300 mm. in length or just over, are to be found in central Tanganyika during December.

Diet. Lizards (*Nucras b. boulengeri* and *Philochortus hardeggeri*), and skinks (*Riopa m. modestum*) recovered from stomachs (Loveridge).

Parasites. A ♀ ascarid in a Mangasini snake.

Habitat. Coastal plain to arid thorn-bush uplands *circa* 4000 feet. So abundant was this species at Saranda during the month of July, that scarcely a day passed without one or two being disturbed as they

[1] As broad as deep in a Sudan specimen according to Werner.
[2] Or twice, presumably for this race, according to Boulenger.
[3] Or four times, presumably this race, according to Boulenger.

basked among the fallen leaves at the base of shrubs, into which they vanished with great celerity. It was then necessary to remain perfectly still and scrutinize the bush until the snake was detected, either lying along a branch to whose surface it has applied its entire length, or else with the anterior third of its body stiffened and projecting into space like a twig.

Localities. **Libya:** Gat, Fezzan. **Anglo-Egyptian Sudan:** Bara, Kordofan; Erkowit; Nahud, Kordofan. **Eritrea:** Beilul near Assab. **Ethiopia:** Abdallah; Dabanah; Harrar (Harari Uen); Hinna (Imi region), Uebi Scebeli; Magala, Umberto Island; Ogaden; Sammane; San Kural; Uebi Mana. **British Somaliland:** Adi Haliss; Berbera to Obbia; Buran district; Gan Lebar; Haud; Hudin; Jifa Uri; Sheik, Golis Mountains; Warabod. **Italian Somaliland:** Bendar Beila; Dolo; Gardo and Hafun, Migiurtina; Nogal; Rahanuin country; Uebi Scebeli. **Uganda:** Ngora, Lake Kioga. **Tanganyika Territory:** Dodoma; Ikikuyu; Kikuyu; Kilimatinde; Lake Manka; Lake Victoria —south end; Mangasini; Saranda; Unyanganyi.

Distribution. Southern Libya (*fide* Scortecci and Zavattari), southeast through the Sudan to Eritrea, Ethiopia and Italian Somaliland north of the Nogal River, and south through the Sudan to Uganda and central Tanganyika. It meets with the typical form at Lake Manka in northeastern Tanganyika Territory and along the border between Ethiopia and Italian Somaliland.

Psammophis biseriatus biseriatus Peters

1881b. *Psammophis biseriatus* Peters, Sitz. Ges. Naturf. Freunde Berlin, p. 88: Teita, Kenya Colony.
1884a. Fischer, Jahrb. Hamburg. Wiss. Anst., **1**, p. 13, pl. i, figs. 4a–4f.
1893b. Stejneger, Proc. U. S. Nat. Mus., **16**, p. 731.
1894. Günther, Proc. Zool. Soc. London, p. 88.
1896c. Boulenger, Ann. Mus. Genova (2), **17**, p. 21.
1896d. Boulenger (part), Cat. Snakes Brit. Mus., **3**, p. 168.
1896. Tornier (part), Kriechthiere Deutsch-Ost-Afrikas, p. 82.
1897. Tornier (part), Arch. Naturg., **63**, **1**, p. 65.
1898a. Boulenger, Ann. Mus. Genova (2), **18**, p. 721.
1898. Tornier (part), in Werther, Mitt. Höch. D.-Ost-Afrikas, p. 297.
1910a. Sternfeld (part), Die Fauna Deutschen Kol., **4**, pt. 1, p. 31.
1911. Lönnberg, Svenska. Vetensk.-Akad. Handl., **47**, No. 6, p. 23.
1912. Hobley, Journ. E. A. Uganda Nat. Hist. Soc., **3**, p. 52.
1912c. Sternfeld, Wiss. Deutschen Zent.-Afrika Exped., **4**, p. 274.
1913. Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 362.

1915c. Boulenger (part), Proc. Zool. Soc. London, p. 631.
1915d. Boulenger (part), Proc. Zool. Soc. London, p. 653.
1916a. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc., **5**, p. 86.
1918a. Loveridge, Journ. E. A. Uganda Nat. Hist. Soc., No. 13, p. 330.
1923b. Calabresi, Atti. Soc. Ital. Sci. Nat., **62**, p. 162.
1924b. Loveridge (part), Journ. E. A. Uga. Nat. Hist. Soc. Supp. 3, p. 6.
1925. Werner (part), 1924, Arch. Naturg., **90**, Abt. A, p. 141.
1928g. Loveridge (part), Bull. Antivenin Inst. America, **2**, p. 40.
1929h. Loveridge, Bull. U. S. Nat. Mus., No. 151, p. 33.
1932a. Parker, Journ. Linn. Soc. London, Zool., **38**, p. 221.
1936h. Loveridge (part), Field Mus. Nat. Hist. Zool. Ser., **22**, p. 39.
1936j. Loveridge, Bull. Mus. Comp. Zoöl., **79**, p. 265.
1936e. Parker, Ann. Mag. Nat. Hist. (10), **18**, p. 608.
1937f. Loveridge (part), Bull. Mus. Comp. Zoöl., **79**, pp. 493, 496.
1937. Pitman (part), Uganda Journ., **4**, p. 240, pl. xi, fig. 3, pl. K, fig. 3.
1938a. Pitman, Uganda Journ., **5**, p. 216.
1939a. Scortecci (part), Ann. Mus. Genova, **63**, p. 281.
1939c. Scortecci (part), Gli Ofidi Velenosi dell' Africa Italiana, p. 145.
1913. *Psammophis bitaeniatus* Peters (*sic*) Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 355 (misprint).

Synonymy. The typical form does not appear to have been confounded with any other species, many of the references to *biseriatus* in the literature refer to the encircling race just described.

Names. Link-marked Sand-Snake, or Two-striped Sand-Snake (English); *mararinga* (Teita).

Description. Rostral broader than deep, visible from above; snout once and a half to once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle, narrower than a supraocular, as long as or slightly shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 shields; loreal twice to thrice as long as deep; preocular 1, rarely 2, broadly, rarely narrowly, in contact with the frontal; postoculars 2; temporals 2 + 2 or 2 + 3, rarely 1 + 2 or 1 + 3; upper labials 9, very rarely 8, fifth and sixth, or very rarely fourth and fifth, fourth, fifth and sixth, or sixth and seventh entering the orbit; 5, rarely 4, lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 15 rows; ventrals[1] 138–156; anal divided, very rarely entire; subcaudals[2] 100–130.

[1] 138 for a Somaliland snake (Scortecci, 1931c, p. 210); he has kindly checked this count for me, June 1938. The previous low number was 143.

[2] All figures below 100 have proved on examination to be truncated with regenerated terminal point. Those of the type, said to be 133, have been recounted by Dr. Ahl and found to be 123.

Coloration. Above, grayish or pale brown, head uniform or with dark brown or reddish-brown, black-edged spots, and usually a dark cross-band on the occiput; a dark streak on each side of the head, passing through the eye; lips white with black or brown spots; a more or less interrupted cream-colored vertebral line down the centre of a dark dorsal band that is flanked by reddish-brown, black-edged spots. Below, belly grayish, speckled with black and white.

Measurements. Largest recorded measures 1050 (650 + 400) mm. (Boulenger). Largest sexed ♀ measures 1020 (660 + 360 + tip) mm. from Mount Mbololo, Kenya Colony (Loveridge).

Diet. Lizards (*Latastia l. revoili*), a skink (*Mabuya planifrons*), and chameleons (*Chamaeleo d. roperi*) recovered from stomachs (Loveridge).

Temperament. Disinclined to bite when captured.

Habitat. Coastal plain to arid thorn-bush uplands *circa* 3000 feet. One has but to examine the markings of one of these snakes to appreciate how remarkably well their cryptic coloring and slender habit simulate the twigs among which they take refuge.

Localities. **Italian Somaliland:** Afghedud; Afgoi; Belet Amin; Biomal; Caaio to Andurgab; Chisimaio (Kismayu); Dargali to Magghiole; Garoe; Giuba (Juba) River; Giumbo (Jumbo); Lugh; Mahaddei Uen; Martis or Dinsai; Mofi; Mogadiscio; Neghelli; Oddur; Ted; Tobungab; Turfa; Uebi Scebeli; Urandi. **Kenya Colony:** Archer's Post; Bulessa; Guaso Nyiro; Kaliokwell River; Karawa; Kipini; Lodwar; Malindi; Mbololo Mountain; Njoro; Patta Island; Sirima, Lake Rudolf; Tana River; Taveta; Teita; Tsavo; Voi. **Tanganyika Territory:** Arusha; Kahe; Kilimanjaro Mountain; Lake Manka; Pentambili; Tanga.

Distribution. Italian Somaliland south of the Nogal River, through the drier regions of Kenya to extreme northeastern Tanganyika Territory near Kilimanjaro Mountain.

Psammophis jallae Peracca

1896. *Psammophis jallae* Peracca, Boll. Mus. Zool. Torino, **11**, No. 255, p. 2, figs.: Kazungula to Bulawayo, Southern Rhodesia.
1898. Sclater, Ann. S. African Mus., **1**, p. 100.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 514.
1910b. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. 1, p. 28.
1910a. Werner, Denks, Med. Nat. Ges. Jena, **16**, p. 363.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 123, 125.
1912. Hewitt, Rec. Albany Mus., **2**, p. 275.

1913e. Hewitt, Ann. Natal Mus., **2**, p. 481.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 141.
1934. Pitman, Rep. Faunal Survey N. Rhodesia, p. 297.
1905c. *Psammophis Ansorgii* Boulenger, Ann. Mag. Nat. Hist. (7), **16**, p. 113, pl. iv, fig. 4: Benguela to Bihe, Angola.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 141.
1933m. Witte, Ann. Mus. Congo Belge, Zool. (1), **3**, p. 93.
1937b. Monard, Arqu. Museu Bocage, Lisboa, **8**, p. 128.
1921d. *Psammophis Rohani* Angel, Bull. Soc. Zool. France, **46**, p. 116, fig.: Near Loengoue, Lumuna River, affluent of Luiana River and tributary of the Kwando River, Angola.
1923d. Angel, in Miss. Rohan-Chabot Angola Rhodesia, **4**, p. 166, figs. 10-12, pl. —, fig. 2.
1937b. Monard, Arqu. Museu Bocage, Lisboa, **8**, p. 128.
1932. *Psammophis longirostris* FitzSimons, V., Ann. Transvaal Mus., **15**, p. 38: Gomodimo Pan, C. Kalahari, Bechuanaland Protectorate.
1935b. FitzSimons, V., Ann. Transvaal Mus., **16**, p. 318, figs. 2–3.

Synonymy. Apparently recorded only under the above names.

Description. Rostral broader than or as broad as deep, visible from above; snout once and a quarter to once and a half as long as the eye; internasals half to two thirds the length of the prefrontals; frontal, in the middle, much broader than a supraocular, as long as or longer than a parietal, much longer than its distance from the end of the snout; nostril between 3, rarely 2[1], shields; loreal once and a half to twice as long as deep; preocular 1, semidivided, broadly in contact with the frontal; postoculars 2, rarely 1; temporals 2 + 2, rarely 1 + 2; upper labials 7, third and fourth entering the orbit; 4 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 15 rows; ventrals 153–177; anal divided; subcaudals [2]97–109.

Coloration. Above, pale gray or grayish brown; snout and supraoculars pale brown, some black-edged yellow (white) spots form a pattern on head of young including a pair of light spots on the suture between the parietal shields; pre- and postoculars yellow (white); a black-edged streak crossing rostral, upper labials and side of head; back uniform or passing to pale brown posteriorly, or a dark, black-

[1] Two on one side only of the type of *ansorgii*.

[2] Seventy-six, recounted as 77/77+1 by Mr. Parker, in type of *ansorgii*, which I have examined and think is probably regenerated though open to question, said to be approximately 153 in type of *jallae* but tail macerated and fragmentary. Prof. Arcangeli, with customary kindness, has reëxamined the type and entirely agrees with my suggestion that 153 is a misprint for 103; owing to its fragmentary condition an exact count is impossible.

edged, dorsal band, five scales wide, not extending to the head; sometimes a vertebral series of elongate yellow (white) spots anteriorly, black posteriorly, forming an interrupted vertebral line; on each side of the body a more or less distinct reddish brown band bordered below by a white streak on the lower half of the outer scale-row and the upper ends of the ventrals. Below, chin and throat spotted with black to form a pattern, midventral region yellow (white).

Measurements. Largest ♀ measures 915 (620 + 295) mm., from Lookaneng (Werner, 1910a, p. 363).

Localities. **Southern Rhodesia:** Importuni district; Kazungula to Bulawayo; Springvale near Matopos. **Bechuanaland Protectorate:** Gomodimo Pan; Lookaneng to Severelela. **Angola:** Benguela to Bihe; Bingondo; near Loengoue. **Belgian Congo:** Kansenia.

Distribution. Southern Rhodesia northeast through Bechuanaland to Angola and the southern Belgian Congo.

Remarks. The description and coloration of this species is a composite based on the description of four species, three of which I refer to the synonymy of *jallae,* the latter being rescued from the synonymy of *crucifer* where it was placed by Boulenger. Known from less than ten specimens in all, the type of *ansorgii* has been the only one which I have been able to examine.

Psammophis crucifer (Daudin)

1758. *Coluber sibilans* Linné (part), Syst. Nat. ed. 10, **1**, p. 222.
1766. Linné (part), Syst. Nat. ed. 12, **1**, p. 383.
1803. *Coluber crucifer* Daudin, Hist. Nat. Rept., **7**, p. 189: "Indes orientales."
1827. *Psammophis crucifer* Boie, in Oken, Isis, **20**, cols. 525, 547.
1854. Duméril & Bibron, Erpét, Gén., **7**, p. 892.
1858c. Günther, Cat. Snakes Brit. Mus., p. 135.
1867a. Steindachner, in Reise Osterreich. Freg. Novara, Zool., **1**, p. 69.
1870. Jan, Icon. Gén. Ophid., livr. 34, pl. iv, fig. 3.
1883b. Boettger, Ber. Offenbach. Ver. Naturk., p. 156.
1884a. Rochebrune, Faune Senegambie. Rept., p. 166 (error).
1887b. Boettger, Ber. Senckenberg. Ges., p. 160.
1887h. Boulenger, Zoologist (3), **11**, p. 176.
1887. Symonds, Proc. Zool. Soc. London, p. 487.
1891a. Matschie, Zool. Jahrb. Syst., **5**, p. 610.
1895b. Boulenger, Proc. Zool. Soc. London, p. 539.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 169.
1897. Bateman, The Vivarium, p. 285.
1898. Boettger, Kat. Rept.-Samm., Mus. Senckenberg. II, p. 104.

1898. Jeude, Notes Leyden Mus., **16**, p. 38.
1898. Sclater, Ann. S. African Mus., **1**, p. 100.
1898. Werner, 1896–7, Jahrb. Abh. Natur. Magdeburg, p. 145.
1901. Schenkel, Verh. Naturf. Ges. Basel, **13**, p. 172.
1902. Lampe & Lindholm, Jahrb. Nassau Ver. Nat. Wiesbaden, **55**, p. 34.
1908b. Boulenger, Ann. Natal Govt. Mus., **1**, p. 229.
1908. Gough, Ann. Transvaal Mus., **1**, p. 29.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 514.
1910b. Sternfeld, Die Fauna Deutschen Kol., **4**, pt. 1, p. 28.
1912. FitzSimons, F. W., Snakes of S. Africa, pp. 123, 126.
1912. Hewitt, Rec. Albany Mus., **2**, p. 270.
1914a. Hewitt, S. African Journ. Sci., **10**, p. 246.
1916. Andersson, Meddel. Göteb. Musei Zool. Afdel., No. 9, p. 36.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 141.
1927b. Hewitt, S. African Journ. Sci., **24**, p. 455.
1929. Rose, Veld & Vlei, p. 162, fig. 106.
1935a. FitzSimons, V., Ann. Transvaal Mus., **15**, p. 522.
1936h. Loveridge, Field Mus. Nat. Hist. Zool. Ser., **22** p. 39.
1937e. Hewitt, Guide Vert. Fauna E. Cape Prov., S. A. II, p. 63, fig. 2.
1837. *Psammophis moniliger* Schlegel (part), Essai Phys. Serp., **2**, p. 209, pl. viii, figs. 6–7.
1883. [1]*Saurophis crucifer* Fisk, Proc. Zool. Soc. London, p. 32.
1892. *Psammophis sibilans* Müller (not Linné), Verh. Naturf. Ges. Basel, **10**, p. 205.

Synonymy. This distinctive species has been confused only with *sibilans* and its synonym *moniliger*, and that but rarely.

Names. Crossed Grass-Snake (English); *kruis gras-slang* and *streep-slang* (Dutch); *intlangu* and *u-nombatamb' ezantsi* (Kaffir).

Description. Rostral broader than deep, visible from above; snout once and a third to once and a half as long as the eye; internasals half to two thirds as long as the prefrontals; frontal, in the middle, as broad as or broader than a supraocular, as long as or slightly shorter than a parietal, much longer than its distance from the end of the snout; nostril between 2 shields; loreal about once and a half as long as deep; preocular 1, not or but very rarely[2] in contact with the frontal; postoculars 2; temporals 2 + 2 or 2 + 3; upper labials 8, rarely 7, fourth and fifth, rarely third and fourth, entering the orbit; 4 lower labials in contact with the anterior sublinguals, which are as long as or

[1] Lapsus for *Psammophis*, as *Saurophis* was proposed for a skink.

[2] One of five Kingwilliamstown snakes exhibited this frontal condition according to Hewitt (1912, p. 270).

shorter than the posterior. Midbody scales in 15, very rarely 17[1], rows; ventrals 136–158; anal divided; subcaudals 62–81[2].

Coloration. Above, pale olive or brownish; head with a light spot or streak on the suture between the parietal shields; pre- and postoculars yellowish; sides of head with large dark blotches; on the back a black-edged dorsal band, three scales wide, usually giving off one or two transverse bars or blotches on the nape; on each side of the body a more or less distinct dark band bordered below by a white streak on the lower half of the outer scale-row and the upper ends of the ventrals. Below, orange or yellow, uniform or finely speckled with blackish or orange-brown markings and a dusky streak or series of small spots along each side. (For a detailed description of a fresh Namaqualand example, see FitzSimons, 1935a, p. 522, and an almost uniform variant from Port Alfred, Hewitt, 1937e, p. 63).

Measurements. Largest example measures 673 (614 + 159) mm. from Kroonstadt (Symonds, 1887, p. 487).

Breeding. Lays from four (Fiske, 1883, p. 32) to half-a-dozen eggs (Rose, 1929, p. 162), *circa* 18 mm. long.

Diet. Gecko (*Phyllodactylus lineatus*) lizards, and frogs.

Enemies. A snake, 470 mm. in length, was found dead in the mouth of a bullfrog (*Rana adspersa*) *fide* Symonds. See Fiske (1883, p. 32) for a strange account of a snake (? *Psendaspis cana*) eating the eggs and attacking an ovipositing crossed snake.

Habitat. This species does not appear to have spread far inland in Cape Province, but does reach the high veld at Doornkop, according to Hewitt (1912, p. 270) in a discussion of locality records. Common in coastal and grassy country inland at least to Lady Frere (Hewitt, 1937e, p. 63).

Localities. **Southern Rhodesia:** Matabeleland. **Transvaal:** Barberton; Johannesburg; Krugersdorp; Lydenburg; Mphome; Smithfield. **Natal:** Hilton Road; Vryheid. **Orange Free State:** Kroonstadt. **Basutoland:** Morija. **Cape Province:** Bathurst district; Beaconsfield; Beaufort West; Brakkloof; Burghersdorp; Capetown; Doornkop; East London; Fransche Kraal; Gaus Bay; Grahamstown; Hondeklip Bay; Irene; Kingwilliamstown; Kleinzee; Lady Frere; Malmsbury; Namaqualand; Port Alfred; Port Elizabeth; Simonstown; Steinkopf; Stellenbosch; Tokai.

[1] One snake examined by Hewitt (1912, p. 270) had 17 rows.

[2] A snake without locality possessed 86 subcaudals according to Andersson (1916, p. 36); its identification requires checking.

Remarks. Hewitt (1912, p. 270) has pointed out that *crucifer* agrees with *sibilans* in lacking a definite backward prolongation of the posterior nasal, such as is found in *notostictus* and '*furcatus*' i.e. *P. sibilans trinasalis.*

Psammophis pulcher Boulenger

1895b. *Psammophis pulcher* Boulenger, Proc. Zool. Soc. London, p. 537, pl. xxx, figs. 3–3a: Webi Shebeli, Ethiopia.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 170.
1897g. Boulenger, Ann. Mus. Genova (2), **17**, p. 279.
1915d. Boulenger, Proc. Zool. Soc. London, p. 654.
1925. Werner, 1924, Arch. Naturg., **90**, Abt. A, p. 141.
1927. Calabresi, Atti. Soc. Ital. Sci. Nat., **66**, p. 55.
1934a. Scortecci, Natura (Milano), **25**, p. 63, fig. 26.
1939c. Scortecci, Gli Ofidi Velenosi dell' Africa Italiana (Milano), p. 144.

Name. Beautiful Sand-Snake (English).

Description. Rostral broader than deep, visible from above; snout once and two thirds as long as the eye; internasals much shorter than the prefrontals; frontal, in the middle slightly narrower than a supraocular, slightly shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 shields; loreal once and two thirds as long as deep; preoculars 2, separated from the frontal; postoculars 2; temporals 1 + 2; upper labials 8, fourth and fifth entering the orbit; 4 lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 13[1] rows; ventrals 144; anal divided; subcaudals 108.

Coloration. Above, pale brownish, with an orange black-edged vertebral stripe, a black lateral streak along the second scale-row passes through the eye and reaches the rostral; upper lip, outer scale-row, and outer ends of ventrals white. Below, ventrals yellow in the middle with an orange line on either side.

Measurements. The ♀ holotype measures 435 (275 + 160) mm.

Remarks. Known only from the type from Ethiopia, *not* Italian Somaliland, as may be seen on reference to Donaldson Smith's maps showing the point at which he crossed the Shebeli River.

Localities. **Ethiopia:** Webi Shebeli south of Harar.

Distribution. Southeastern Ethiopia.

[1] Checked and found correct. A. L.

Psammophis angolensis (Bocage)

1872. *Amphiophis angolensis* Bocage, Jorn, Sci. Lisboa, **4**, p. 82: Donda, *i. e.* Dondo, Loanda, Angola.
1881d. Peters, Sitz. Ges. Naturf. Freunde Berlin, p. 149.
1895a. Bocage, Herp. Angola Congo, p. 113, pl. xi, figs. 3a-3f.
1896a. Bocage, Jorn, Sci. Lisboa (2), **4**, p. 103.
1896. Tornier, Kriechthiere Deutsch-Ost-Afrikas, p. 82.
1897a. Bocage, Jorn. Sci. Lisboa (2), **4**, p. 201.
1877c. *Ablabes Homeyeri* Peters, Monatsb. Akad. Wiss. Berlin, p. 620: Pungo Adungo (Ndongo), Angola.
1888a. *Dromophis Angolensis* Boettger, Ber. Senckenberg. Ges., p. 55.
1890b. Boulenger, Ann. Mag. Nat. Hist. (6), **6**, p. 93.
1891a. *Psammophis angolensis* Boulenger, Proc. Zool. Soc. London, p. 307.
1895b. Boulenger, Proc. Zool. Soc. London, p. 539.
1896d. Boulenger, Cat. Snakes Brit. Mus., **3**, p. 170.
1897e. Boulenger, Proc. Zool. Soc. London, p. 801.
1897. Tornier, Arch. Naturg., **63**, p. 65.
1898. Boettger, Kat. Rept.-Samm. Mus. Senckenberg. II, p. 104.
1898. Johnston, British Cent. Africa, p. 361a.
1908c. Sternfeld, Mitt. Zool. Mus. Berlin, **4**, p. 246.
1910b. Boulenger, Ann. S. African Mus., **5**, p. 514.
1910. Peracca, Boll. Mus. Zool. Torino, **25**, No. 624, p. 4.
1910a. Sternfeld, Die Fauna Deutschen Kol., **3**, pt. 2, p. 31.
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1934. Pitman, Rep. Faunal, Survey N. Rhodesia, p. 297.
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Synonymy. Peters (1881d, p. 149) himself referred *homeyeri* to the synonymy of *angolensis*, a species which does not appear to have been confused with any other.

Name. Pigmy Sand-Snake (English).

Description. Rostral broader than deep, visible from above; snout

once and a quarter to once and a half as long as the eye; internasals half to two thirds as long as the prefrontals; frontal, in the middle, slightly narrower or broader than a supraocular, as long as or slightly shorter than a parietal, longer than its distance from the end of the snout; nostril between 2 shields; loreal once and a half to twice as long as deep; preocular 1, separated from, rarely in contact with, the frontal; postoculars 2, rarely 3; temporals 1 + 2, rarely 2 + 2; upper labials 8, rarely 7, fourth and fifth entering the orbit; 4, rarely 5, lower labials in contact with the anterior sublinguals, which are shorter than the posterior. Midbody scales in 11 rows; ventrals 141–156; anal divided; subcaudals 57–82.

Coloration. Above, pale or dark olive; head dark olive anteriorly, blackish posteriorly, with three yellow transverse lines, the first across the frontal, the second across the parietals, the third behind the parietals; two black crossbands, separated by a yellowish interspace, may be present on neck; labials yellowish white; a dark olive or blackish vertebral stripe, mostly three scales wide, and finely edged with black on dorsum and tail; one or two more or less distinct dark lines or series of dots along each side. Below, white, a fine lateral line on either side of the ventrals, present or absent.

Measurements. Largest recorded measures 417 (306 + 111) mm. from Morogoro, Tanganyika Territory (Loveridge).

Temperament. Makes no attempt to bite when captured.

Habitat. Upland savanna to coastal plain. I have taken this species in a dried-up swamp, on a path, and ensconced in the grass wall of a hut at a height of five feet from the ground.

Localities. **Zanzibar:** Zanzibar. **Tanganyika Territory:** Bagamoyo; Dar es Salaam; Izikisia; Kilosa; Morogoro; Lake Tanganyika; Lake Victoria—south shore; Unyanganyi. **Mozambique:** Tschimbo. **Nyasaland:** Cape McClear; Fort Hill, Masuka district; Fort Johnston. **Northern Rhodesia:** Lealui; Munyamadzi River; Zambesi (upper). **Belgian Congo:** Albertville; Kansenia; Kahiri; Katanga; Kiambi to Baudouinville; Lukafu. **Angola:** Ambrizette; Caconda; Dondo; Humbe; Malange (Malanji); Novo Redondo; Pungo Adungo (Ndongo) Quindumbo.

Distribution. Tropical Africa from Zanzibar, Tanganyika Territory, and Mozambique west through Nyasaland, Northern Rhodesia and the Belgian Congo to Angola.

Remarks. Hewitt (1912, p. 275) justifiably questions Boulenger's (1910b, p. 515) inclusion of the Orange Free State in the range of *angolensis,* hence its omission from the above distribution.

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AT HARVARD COLLEGE

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NEW ORIENTAL CICADIDÆ IN THE MUSEUM OF COMPARATIVE ZOÖLOGY

By Gaines Kan-Chih Liu

With Seven Plates

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No. 2.— *New Oriental Cicadidæ in the Museum of Comparative Zoölogy*

By Gaines Kan-Chih Liu

FOREWORD

Just after passing his Doctor's examination and having finished his thesis, Doctor Liu was required by his Government to return to China.

The thesis, as finished in partial fulfilment of the requirements for his doctorate, contained much material of a general nature and many, many details which had been published and which it was neither desirable nor necessary to publish again.

Since it has been impossible to communicate with Doctor Liu, I asked Mr. Nathan Banks to take this manuscript and indicate those sections which might be considered as new. This he has done with painstaking care and great skill and it is only fair that the part which he has played in making possible the publication of this manuscript should be gratefully acknowledged. Doctor Liu would be the first person to do this were it possible. Since it is not, I do so in his name.

T. Barbour.

INTRODUCTION

This study is based on the collections in the Museum of Comparative Zoölogy, supplemented by others made in China during 1931–1933 by the writer, when holding a Parker Fellowship from Harvard University.

I have decided to follow the classification used by Distant for the Cicadidæ in the Fauna of British India. This arrangement is by no means satisfactory; but since Distant's publications are indispensable for the study of the Oriental Cicadidæ, especially the Chinese fauna, it is deemed better for the present not to make any change.

The terminology employed for descriptions in this paper is also practically the same as that of Distant. I have found it convenient to coin a new term, "incisurial area," for the description of the markings of the two lateral areas on the disk of the pronotum. These areas, where the so-called "incisures" are located, are usually well defined.

The Chinese Cicadidæ are badly in need of revision. Since Distant's Monograph of Oriental Cicadidæ, the number of species known to occur in China has been more than tripled. The total represents the

efforts of a number of workers of different nationalities. As a consequence, the characters emphasized are different, and each worker seems to have had a different concept of what should constitute a species.

Acknowledgments

The writer is most grateful to Mr. Banks and also wishes to thank Dr. T. Barbour for the opportunity to publish this paper, and Prof. C. T. Brues for his encouragement and interest in his work.

Genus Platypleura Amyot and Serville

Key to the Species

1. Mesonotum with three obconical spots . . . . *semusta*
   Mesonotum with four obconical spots 2
2. Tegmina and wings with the apical half hyaline and the basal half more or less opaque . . . . *coelebs*
   Tegmina and wings in general opaque 3
3. Lateral margins of pronotum rounded; outer margins of wings (excluding anal area) dark brownish; rostrum passing just behind the posterior coxæ . . . . *hilpa*
   Lateral margins of pronotum angulate; outer margins of the wings hyaline; rostrum extending far behind the posterior coxæ 4
4. Anal tergite largely exposed, rostrum passing beyond the posterior margin of opercula; abdomen gradually narrowed behind; color brown . . . . *kæmpferi*
   Anal tergite retracted, rostrum hardly reaching the posterior angle of opercula; abdomen abruptly narrowed behind and shorter than the anterior half of the body; color greenish . . . . *retracta*

Platypleura kaempferi Fab.

Plate 1, Fig. 2

Occurs along coastal plain of China as far north as Peiping.

Platypleura retracta spec. nov.

Plate 1, Fig. 3

The general marking of this species is more or less similar to that of *P. kæmpferi*. But, besides those structural differences, as shown below,

which mark it as a distinct species, the general color is greenish, the abdomen more abruptly narrowed behind and shorter than the anterior half of the body. It is also more pilose.

Head deflected in front and about as wide as the base of mesonotum. Vertex black with the following markings yellowish-green:—four large spots in front of the posterior margin, a transverse fascia between the eyes across the base of the tylus, and a spot on the anterior lateral margin. Tylus yellowish-green with the lateral margin and an angulated transverse fascia fuscous. Antennæ brown. Eyes brown. Ocelli shining red and about twice as far from the eyes as from each other.

Pronotum about three times as wide as long and about as long as mesonotum (excluding cruciform elevation). The lateral margins broadly ampliated and angulate in the middle. The disk yellowish-green with a central longitudinal lanceolate fascia and three oblique fasciæ on the incisurial area black. The lateral marginal area black with the extreme margins dull ochraceous.

Mesonotum yellowish-green with four obconical fasciæ from the anterior margin and a radiate spot in front of the cruciform elevation black. The anterior arm of the radiate spot extending to the anterior margin and the posterior one to the disk of the elevation. The lateral marginal area of the radiate spot piceous. The extreme lateral margins paler.

Abdomen (9 mm.) much shorter than the anterior half (11 mm.) of the body, abruptly narrowed behind, covered with appressed silvery pile, and dull black with the posterior margins of tergites 3–6 greenish. The inner angle of the tympanal orifice somewhat exposed. Flaps black with the inner marginal area ochraceous. Anal tergite concealed, sometimes with only the apical part projected outside.

Tegmina about one-third longer than the body, a little less than three times as long as wide, with the markings as shown in the figure. Plate 1, Fig. 3. Venation partly greenish and partly brown. Basal cell broadly triangular with the point at the base. Wings fuscous with the outer and the posterior marginal area hyaline. Venation reddish-ochraceous with the median and the cubital vein black and the anal vein pale piceous.

Body beneath with the thoracic part pulverulent. Face black with the lateral transverse stripes reddish-ochraceous and deeply and longitudinally sulcate in the middle. Clypeus black with a short longitudinal spot at the base reddish-ochraceous. Lateral margin of lora, basal segment of rostrum, apices of femora, annulations on tarsi, streaks on anterior femora, and the posterior margin of opercula

ochraceous. Apical segment of rostrum and legs reddish. Abdominal ventrites black.

Opercula broad, overlapping on the inner angles, convex on the outer and posterior margin, and not reaching the posterior margin of the second abdominal ventrite. Rostrum hardly reaching the posterior angle of the opercula. Seventh ventrite with the width of its anterior margin longer than its length (in *kæmpferi,* about as long as). Body length 20 mm. Widest part of pronotum 12 mm. Tegmina length 24 mm.

Holotype male from Mt. Chingchen, Kuanshien, Szechuan, July, 1932, in author's collection. One of the paratypes from the same locality is in the M. C. Z.

Platypleura retracta omeishana var. nov.

This variety differs from the typical form in the following points: rostrum passing the posterior coxæ but far from the posterior angle of the opercula. The lateral obconical black fascia enclosing a small ochraceous spot near the anterior margin. Transverse stripes on abdominal tergites dilated in the middle. The lateral arms of the radiate spot of the mesonotum isolated to form two small spots in front of the anterior arms of the cruciform elevation.

One male from Mt. Omei, Szechuan, July, 1932.

Platypleura hilpa Walker

Plate 1, Fig. 4.

Known from Canton, Amoy, and Foochow.

Genus Pycna Amyot and Serville

Key to Species

Wings black with their outer "fourth" pale hyaline; tegmina pale hyaline with the basal part brownish opaque.......... *coelestia*

Wings ochraceous with the apical area (sometimes the apex of the anal area too) dark castaneous; tegmina with the basal half opaque but the dark fascia on the apical area more concentrated *repanda*

Pycna repanda Linnæus

Plate 1, Fig. 1

According to Haupt occurs on Mt. Omei, Szechuan.

Genus Polyneura Westwood

This genus contains only one species known from India to Tibet. Its alignment with the last two genera appears to be rather superficial.

Polyneura ducalis Westwood

Plate 2, Fig. 7

Reported from Szechuan and Tibet.

Genus Graptopsaltria Stal

Key to Species

Mesonotum almost entirely black with only two faint obconical fasciæ from the anterior margin; pronotum with the posterior marginal area black; vertex black with four testaceous spots between the eyes; tympanal flaps broader than long . . . *colorata.*

Mesonotum with four large obconical fasciæ from the anterior margin; pronotum with the posterior marginal area olivaceous; vertex with a broad olivaceous fascia between the eyes; tympanal flaps longer than broad . . . . *tienta*

Graptopsaltria colorata Stal

Plate 2, Figs. 9, 10

Known from Hangchow and Manchuria.

Graptopsaltria tienta Karsch

Plate 2, Fig. 8

Occurs only at Mt. Omei, Szechuan.

Genus Chremistica Stal

Key to the Species

1. Opercula about half the length of abdomen; tegmina and wings clear and hyaline; body uniformly ochraceous .... *ochracea*
   Opercula not extending much beyond the base of abdomen; body not ochraceous 2
2. Mesonotum castaneous with four obscure slender fasciæ from the anterior margin and a small golden patch of pile on the anterior lateral angles; head castaneous with the ocellar region darker and two paler brownish spots near the anterior margin; tegmina and wings hyaline with the veins on the apical margin infuscated *banksi*
   Mesonotum black without golden patches; head black with some reddish spots but not as in the preceding one; tegmina and wings hyaline, the former on basal two-thirds moderately tinged with ochraceous .... *minuta*

Chremistica banksi spec. nov.

Plate 3, fig. 15

A large, dull castaneous, and hairy cicada, easily recognized by the two small golden patches on the mesonotum. Tegmina and wings hyaline with the ambient veins infuscated.

Body above dull castaneous. Head declivous in front, about half as long as the space between eyes, and more narrow than the base of mesonotum. Crown centrally and longitudinally sulcate, dull castaneous with the following markings reddish-ochraceous:—a spot on anterior lateral margin, a large spot in the middle of the lateral area, and a very small spot before the middle of the posterior margin. Antennæ castaneous. Eyes brown. Ocelli reddish and about three times as far from the eyes as from each other.

Pronotum about twice as long as wide and longer than mesonotum with exclusion of the cruciform elevation. Lateral margins ampliated and convex. Color uniformly dull castaneous but with the marginal area paler and a faint slender longitudinal central fascia in the middle of the incisurial area.

Mesonotum uniformly dull castaneous with two faint, threadlike, and convergent fasciæ from the anterior margin and a small golden patch on the anterior lateral angle. Lateral area of cruciform elevation paler. Posterior lateral margin fringed with long silvery hairs.

Abdomen longer than the anterior half of the body, covered rather thickly with long white hairs on the lateral areas and uniformly black except the tympanal flaps and the posterior lateral part of the second and the eighth tergite. Anal tergite broadly indented on the posterior margin with a large ochraceous spot on the lateral area. Tympanal orifice completely covered.

Tegmina and wings hyaline. Tegmina only a little longer than the body and less than three times as long as wide. Venation fuscous with the apical third infuscated. Basal cell elongate, about twice as long as wide, and with the lower vein curved downward. Wings with the apical margin infuscated and the venation pale brownish.

Body beneath reddish ochraceous and thickly covered with long hairs. Face, the region between the face and the eyes, rostrum, legs, and the first abdominal ventrite castaneous. Apices of femora and bases of tibiæ ochraceous. Face very prominent.

Opercula not reaching the posterior margin of the second abdominal ventrite, parallel laterally, slightly oblique and almost truncate posteriorly, and with the inner angles overlapping. Inner marginal area castaneous. Rostrum passing beyond the posterior coxæ with the base ochraceous. Seventh ventrite slightly sinuate on the posterior margin and almost as long as the preceding two united. Genital plate short and hidden from above by the anal tergite.

Body length 41 mm. Widest part of pronotum 15 mm. Tegmina length 46 mm.

Holotype male from China, in Coll. M. C. Z. Paratypes one female and two males.

This insect is dedicated to N. Banks, curator of insects in the Museum of Comparative Zoölogy, Harvard. It was found in the old Harvard collection, but with no more definite locality than "China." The color of this species is variable. The mesonotum is sometimes black and the anterior disk of pronotum sometimes paler.

Genus Lyristes Horvath

Key to the Species

1. Opercula long and reaching beyond the middle of abdomen; tegmina hyaline with cross-veins of apical cells 2, 3, 4, 5, and 7 infuscated; pronotum castaneous with the margins and a central longitudinal fascia and two basal spots ochraceous . . . . *leechi*

   Opercula short and not extending beyond the second abdominal ventrite 2

2. Tegmina with the basal third opaque, the rest hyaline with the cross-veins of the first apical cell infuscated; pronotum black with two small spots on the disc and the margins (except the lateral anterior half) black . . . . *wui*
   Tegmina hyaline 3
3. Tegmina without any infuscation on the apical veins, very close to *sinensis* . . . . *pekinensis*
   Tegmina with cross-veins in the apical area infuscated 4
4. Tegmina with cross-veins of apical cells 2, 3, 5, and 7 infuscated; pronotum castaneous with the marginal areas, two basal spots, and a lanceolate fascia in the middle ochraceous . . . . *flammata*
   Tegmina with cross-veins of apical cells 2 and 3 infuscated 5
5. Rostrum reaching behind posterior coxæ; opercula rounded laterally and somewhat pointed posteriorly; pronotum olivaceous with two fuscous stripes on the posterior margin near the lateral angles . . . . *sinensis*
   Rostrum reaching only the anterior margin of the posterior coxæ, opercula parallel laterally and broadly truncate posteriorly; pronotum smoky pale-ochraceous with four spots from the anterior margin and two longitudinal fasciæ in the middle black *altaiensis*

Lyristes flammata Distant

Plate 4, Fig. 18.

From Lushan, Kiangsi.

Lyristes sinensis Distant

Plate 4, Fig. 19

From Tat-sien-lu, Szechuan.

Genus Cryptotympana Stal

Key to the Species

1. Tegmina darkly infuscated; opercula somewhat pointed, concavely sinuate, and reaching the middle of the third abdominal ventrite; rostrum extending behind the middle coxæ . . . . *holsti*
   Tegmina hyaline or lightly infuscated 2

2. Body above olivaceous; opercula broadly truncate behind and reaching the second abdominal ventrite; rostrum extending to the middle coxæ; tegmina and wings hyaline with the basal portion tinged with pale ochraceous . . . . *sinensis*
   Body black or castaneous 3
3. Abdomen with a large greyish-white fascia on each lateral area; opercula acute and reaching nearly the posterior margin of the fourth abdominal ventrite; rostrum reaching posterior coxæ; tegmina hyaline with the cross-veins of the second and the third apical cells infuscated . . . . *acuta*
   Abdomen black without such white fascia 4
4. Opercula concavely sinuate on the posterior margin; tegmina with the post-costal area blackish; rostrum reaching the middle coxæ *mandarina*
   Opercula not concavely sinuate; tegmina with the post-costal area clear 5
5. Opercula ochraceous; tegmina with the opaque area not extending beyond the basal cell 6
   Opercula not ochraceous except the marginal areas; tegmina with the opaque area extending beyond the basal cell 7
6. Abdomen black with the basal segment narrowly margined with greyish-white pile; opercula broadly rounded behind; size large *fascialis*
   Abdomen black with a narrow white fascia in the middle of the third segment; opercula pointed posteriorly; size smaller . . . . . . *japonensis*
7. Abdomen (except the last two segments) yellowish-brown at the lateral and posterior margin of each segment; tegmina with the basal third somewhat infuscated . . . . *santoshonis*
   Abdomen black; tegmina with the basal fourth opaque 8
8. Opercula truncate on the inner side and rounded outside, reaching the middle of the second abdominal ventrite, and with the outer margin ochraceous . . . . *pustulata*
   Opercula broadly rounded posteriorly not reaching the posterior margin of the basal segment, and with the posterior and external margin broadly ochraceous . . . . *dubia*

Cryptotympana mandarina Distant

Plate 3, Fig. 13

Reported from Hong Kong and Hainan.

Cryptotympana pustulata Fabricius

Plate 3, Fig. 14

Known from the Coastal Plain as far north as Peiping, and inland to Ichang, Hupeh and Taiynan, Shansi.

C. pustulata castanea var. nov.

This variety can be readily separated from the typical form by the following points: Opercula uniformly castaneous. Lateral areas of pygofer concolorous with the ventrite, not differently colored as in the typical form. Pronotum with three obscure reddish oblique fasciæ on the incisurial area and without ochraceous spots on the lateral margins. The general color of the body is castaneous but much darker above.

A single specimen labeled "China" in Harvard collection. In this variety, the opercula do not extend beyond the posterior margin of the second abdominal ventrite.

C. pustulata fukienensis var. nov.

This variety differs from the typical form by having the opercula definitely pointed behind, or somewhat peach-shaped, with the pointed tip just touching the posterior margin of the second abdominal ventrite. The ochraceous region is narrowed down to a slender stripe on the outer margin. One male from Foochow, Fukien.

Genus Purana Distant

Key to the Species

Tegmina and wings with the claval area infuscated, cruciform elevation with a large black spot in front. . . . . *davidi*

Tegmina and wings with the claval area hyaline; cruciform elevation with two small black spots in front of the anterior arms *clavohyalina*

Purana clavohyalina spec. nov.

Plate 4, Fig. 20

This is a small testaceous cicada with black markings and clear wings. Tegmina are decorated with a series of four fuscous spots in the apical half. It can be easily separated from *davidi* by having the claval area of both tegmina and wings not infuscated.

Head declivous in front, as long as the space between eyes, and as wide as the base of mesonotum. Vertex reddish-ochraceous with the inner margin of eyes and a radiate spot extending to the anterior lateral margins of the vertex. Tylus with a pale smooth spot on the apex and the lateral striations dark castaneous. Eyes prominent, projecting, and together as wide as the space between them. Ocelli shining and about twice as far from the eyes as from each other.

Pronotum narrowed anteriorly, toothed laterally, ampliated at the posterior angles, and shorter than mesonotum with the exclusion of the cruciform elevation. The general color is reddish-ochraceous with the marginal area pale yellow. The margin of the incisurial area (except a short part on the posterior side), the extreme posterior and anterior margins, and a central longitudinal fascia (widened at both ends) black. The longitudinal central black fascia enclosing a lanceolate reddish ochraceous fascia in the center. Anterior lateral margins and two spots on the posterior angles castaneous.

Mesonotum reddish-ochraceous with five longitudinal fasciæ from the anterior margin black. The middle one more slender and extending to the cruciform elevation where it branches into three arms, two lateral and one posterior. The two lateral ones are broad and broken and also extend to the posterior margin. The two sublateral ones reach only the middle.

Abdomen (15 mm.) nearly as long as the anterior half of the body, nearly parallel laterally, reddish-ochraceous with the posterior margins castaneous and the lateral areas much paler. Tympanal orifice completely covered. Flaps dull ochraceous. Eighth tergite very small and about as long as the preceding one. Anal tergite retracted and sometimes not visible.

Tegmina and wings hyaline with the venation partly ochraceous and partly fuscous. Tegmina more than three times as long as wide with the cross-veins of apical cells 2, 3, 5, and 7 infuscated. Basal cell oblong with the base wider than the apex. A spot at the apex of radial area brightly ochraceous.

Body beneath pale ochraceous. Face prominent, globose, slightly

longitudinally sulcate in the middle, castaneous with the transverse striations and the lateral and posterior margins ochraceous. The region between the face and the eyes, and part of the lora, black. Legs more or less testaceous with ochraceous streaks. Abdominal ventrites pale testaceous. Tubercles prominent and castaneous.

Rostrum reaching the middle of the base of abdomen with the apex castaneous. Opercula pale ochraceous with the base and the lateral margins pale castaneous. Posterior angles extending beyond the second abdominal ventrite. Inner angles widely separated. Seventh ventrite reddish with the posterior part pale ochraceous and the posterior margin indented in the middle. Genital plate elongate, rounded behind, and wrinkled on the disc.

Body length 29 mm. Widest part of pronotum 10mm. Tegmina length 38 mm.

Holotype male from Foochow, Fukien, in Harvard collection. Two paratypes from the same locality.

Genus Maua Distant

Key to the Species

1. Rostrum reaching the middle of the third abdominal ventrite; opercula about as broad as long; tegmina with four infuscated spots *fukienensis*

   Rostrum not passing the posterior margin of the second abdominal ventrite 2
2. Opercula much longer than broad; tegmina with the only two infuscated spots in the apical area; size large 4-*tuberculata*

   Opercula broader than long or as broad as long; tegmina with more than two infuscated spots (Walker says that the first four cross-veins are clouded with brown but the figure given by Distant shows only three fuscous spots) . . . . *albistigma*

Maua fukienensis spec. nov.

Plate 4, Fig. 21

This species is evidently very close to *albistigma* but can be readily separated by the length of the rostrum which reaches the middle of the third abdominal ventrite in this one while in *albistigma*, only the "hind hips." On the other hand, it may be easily confused with the European *Tettigia orni* Linnaeus. The markings on tegmina resemble closely those of *Purana clavohyalina*.

Head declivous in front, shorter than the space between eyes, and wider than the base of mesonotum. Vertex dull ferrugineous and decorated with an obscure black mark. Tylus with a shining spot at the apex. Eyes prominent, projecting, and together about as wide as the space between them. Ocelli about twice as far from the eyes as from each other.

Pronotum narrowed anteriorly, sinuate laterally, dilated at posterior angles, nearly three times as wide as long, and shorter than mesonotum with the exclusion of the cruciform elevation. Color reddish ochraceous with the anterior extreme margin black. The extreme posterior margin, two large spots on the marginal area near the posterior angle, lateral margins, and the margins of the incisurial areas more or less castaneous. The inner margin of the two incisurial areas forming a central lanceolate fascia in the middle, which is ochraceous. Mesonotum reddish ochraceous with five black fasciæ from the anterior margin.

Abdomen (14 mm.) shorter than the anterior half of the body, uniformly ferrugineous with some fuscous spots on the deflected lateral areas. Tympanal orifice completely covered. Flaps ochraceous. Eighth tergite very small and shorter than the preceding one. Anal tergite not visible.

Tegmina and wings hyaline. Venation partly ochraceous and partly fuscous. Tegmina more than three times as long as wide with the apex of the radial area ochraceous and the cross-veins of apical cells, 2, 3, 5, and 7 infuscated. Basal cells nearly four times as long as wide. Cross-veins of apical cell 3 and 7 curved.

Body beneath paler in hue. Face prominent, globose and fuscous with the lateral striations and lateral margins ochraceous. Areas between face and eyes black. Rostrum ochraceous with apex fuscous. Legs more or less reddish or reddish ochraceous. Abdomen beneath pale ferrugineous with posterior segmental margins ochraceous. Tubercles large, prominent, and uniformly reddish. With the specimen on hand, the lateral area of abdomen sunk in and thus forming two grooves with a central ridge. The tubercles are located in these grooves.

Rostrum reaching the middle of the third abdominal ventrite. Opercula short, reaching as far as the rostrum, with the outer margin nearly straight, inner margin convex, and the inner angles well separated. Seventh ventrite prominently sulcate on the posterior margin.

Body length 28 mm. Widest part of pronotum 11 mm. Tegmina length 40 mm.

Holotype male from Foochow, Fukien, in Harvard collection.

This species displays so close a resemblance to *Purana clavohyalina*,

especially the markings of the body and tegmina, that it may be easily confused. However, in addition to the generic differences and differences in the color markings of the opercula and the abdomen above, there are many other distinguishing characters. For instance, in *P. clavohyalina*, the opercula pass the anterior border of the third abdominal ventrite but the rostrum does not reach the posterior margin of the second ventrite, the cross-veins of apical cells 3 and 7 straight, and the posterior margin of the seventh ventrite only slightly sulcate; while in this one, both rostrum and opercula reach the middle of the third ventrite, cross-veins of apical cells 3 and 7 curved, and the posterior margin of the seventh ventrite prominently sulcate.

Genus Tanna Distant

Key to the Species

1. Tegmina and wings with the apical angles piceous; the former with the cross-veins of apical cells 2 and 3 infuscated .... *herzbergi*
   Tegmina and wings with the apical angles hyaline; the former with two series of infuscated spots on the apical area 2
2. Tegmina with the cross-veins of apical cells 5 and 7 more or less parallel to the ambient vein, the third apical cell rectangular, and the basal vein of the fourth one not infuscated; wings with the cross-vein of the first apical cell curved and the second apical cell obliquely truncate at base; size smaller; color paler . . .*japonensis*
   Tegmina with the cross-veins of apical cells 5 and 7 not parallel to the ambient vein, the third apical cell pointed at base, and the upper arm of the fourth one infuscated; wings with the first cross-vein straight and the second apical cell acutely pointed at base; size much larger; color darker .... *obliqua*

Tanna japonensis Distant

Plate 4, Fig. 23.

Known from Hangchow and Manchuria.

Tanna obliqua spec. nov.

Plate 4, Fig. 22

This insect in general appearance is very close to *T. japonensis* except larger and darker and may be easily confused. However, there

are a number of structural differences and it can be easily separated from the Japanese form, as pointed out in the key, by the form of the first cross-vein of the wing.

Body above rusty brown. Head declivous in front, about as long as the space between eyes, and narrower than the base of mesonotum. Vertex green with the inner margin of the eyes (not extending to the front) and two transverse fasciæ black. The anterior transverse fascia enlarged on the anterior lateral margin and again in the middle to include the anterior ocellus. The posterior one does not extend to the lateral margin but is deeply curved and also enlarged in the middle to enclose the two posterior ocelli. Disc sparingly covered with golden pile. Eyes prominent, projecting, and together about as wide as the space between them. Ocelli about twice as far from the eyes as from each other.

Pronotum slightly longer than head, about two-thirds as long as mesonotum (excluding cruciform elevation), distinctly narrowed anteriorly, ampliated at the posterior angles, sinuate and rather bluntly toothed laterally. Disc sparingly covered with golden pile, rusty brown with the central longitudinal fascia and the marginal area yellowish green. The extreme anterior and posterior margins, margins of incisurial areas, and two large spots near the posterior angle fuscous.

Mesonotum greenish brown with five fuscous longitudinal fasciæ from the anterior margin. The central one extends to cruciform elevation where it is enlarged and encloses two small ochraceous spots. The lateral two also reaching the cruciform elevation but the sublateral two the shortest.

Abdomen (23 mm.) much longer than the anterior half of the body, sparingly covered with silvery and golden pile, and rusty brown with posterior segmental margins pale fuscous. Tympanal orifice somewhat exposed externally. Flaps fuscous with the central disc pale ochraceous. Outer margin sinuate. Anal tergite truncate behind and reaching not as far as the genital plate.

Tegmina and wings hyaline. Tegmina more than three times as long as wide with two series of fuscous spots on the apical area. Inner series consisting of five (counting the fork of the second one as two) and the outer one of seven. Venation partly green and partly fuscous with a spot at the apex of radial area bright pale yellow. Cross-veins of apical cells 5 and 7 oblique to the ambient vein and the third apical cell pointed at base. Basal cell about three times as long as wide with the lower vein nearly straight and not curved as in the Japanese

species. Wings with the venation partly greenish, partly ochraceous, and partly fuscous. Cross-vein of the first apical cell oblique and straight and the base of the second one pointed.

Body beneath with the anterior part greenish and the abdominal part pale. Head and thorax beneath, coxæ, femora, middle tibiæ, and opercula yellowish green. Transverse striæ on face, spots on lora and clypeus, a small spot between face and eyes, streaks on legs, and apex of rostrum fuscous. Tarsi and tibiæ of anterior and posterior legs and rostrum ochraceous. Anterior tibiæ and tarsi brown. Abdominal ventrites pale with the first pair of tubercles prominent and brown and the pair on the third segment much smaller and darker.

Opercula greenish with the base and the outer margin fuscous. Posterior angles extending far beyond the second ventrite. Inner angles widely separated. Outer margin convexly sinuate. Rostrum passing beyond posterior coxæ. Seventh ventrite nearly parallel laterally, slightly indented behind, about as long as the preceding one but shorter than the genital plate.

Body length 39 mm. Widest part of pronotum 11 mm. Length of tegmina 44 mm.

Holotype male from Mt. Omei, Szechuan, July, 1932 in author's collection. Six paratypes from the same locality in Harvard collection.

Genus Dundubia Amyot and Serville

Key to the Species

Opercula broadly rounded behind and reaching the posterior margin of the sixth ventrite; mesonotum without distinct markings. *mannifera*

Opercula pointed behind and reaching the posterior margin of the seventh ventrite; mesonotum with two convergent black slender faciæ from the anterior margin; size larger . . . .*bifasciata*

Dundubia mannifera Linnaeus

Plate 5, Fig. 25

Known from many places in China.

Dundubia bifasciata spec. nov.

Plate 5, Fig. 24

In size and form, this insect closely resembles *D. mannifera*. The tylus is less prominent but still twice as wide as the anterior lateral

margin of the vertex. It can be distinguished, however, from *mannifera* by the presence of two sharply marked slender fasciæ on the mesonotum.

Body above brownish and sparingly covered with pile. Head declivous in front, about five-sixths as long as the space between eyes, and wider than the base of mesonotum. Tylus twice as wide as the anterior lateral margin of vertex and reddish with a central ochraceous fascia extending to the face. Vertex pale brown, slightly tinged with green, and with the ocellar region castaneous. Ocelli less than twice as far from the eyes as from each other.

Pronotum pale brownish, longer than head, shorter than mesonotum (excluding cruciform elevation), and bluntly toothed on the lateral margins. Extreme posterior margin and a transverse spot before the middle of the posterior marginal area black. Marginal area greenish with two spots near the posterior angle and the anterior lateral angles fuscous.

Mesonotum shining pale brown, with two convergent slender black fasciæ from the anterior margin. Abdomen (22 mm.) longer than, or nearly as long as, the anterior half of the body, and pale brownish above with the tympanal coverings greenish. Eighth tergite pulverulent. Anal tergite not visible.

Tegmina and wings hyaline. Venation ochraceous with the apical portion fuscous. Lower vein of claval area dark fuscous. Some of the veins of wings greenish or green. Tegmina more than three times as long as wide. Basal cell three times as long as wide.

Body beneath duller. Face, lora, and streak on anterior and middle femora pale brownish. Antennæ, apical region of rostrum, tibiæ and tarsi of anterior and middle legs dark fuscous. Basal fascia on face, rostrum, streaks on middle tibiæ, posterior legs, and abdomen beneath ochraceous.

Rostrum passing the middle coxæ. Opercula greenish (in the paratype, the right one fuscous) with the outer margin near the base fuscous, reaching the posterior margin of the seventh ventrite, concavely sinuate near base and then ampliated and gradually narrowed toward the apex which is somewhat pointed. Seventh ventrite narrowed posteriorly, produced into two little lobes behind, and longer than the preceding one. Genital plate small and pointed behind.

Body length 40 mm. Widest part of pronotum 13 mm. Length of tegmina 47 mm.

Holotype male from Yungshien, Kwangsi, May, 1932, in author's collection. One male paratype from the same locality in Harvard collection.

Genus Platylomia Stal

Key to the Species

1. Opercula in male extending back as far as the middle of the abdomen and about as wide at base as on disc of apical area; cross-vein of the second and the third apical cell of tegmina slightly infuscated . . . . *juno*
   Opercula in male extending far beyond the middle of the abdomen, even sometimes reaching the penultimate segment 2
2. Tegmina with the cross-veins of apical cells 2, 3, 5, and 7 infuscated; opercula reaching the last segment of abdomen; tegmina and wings slightly smoky . . . . *lemoultii*
   Tegmina with the cross-veins of apical cells 2, 3, 5, and 7 either clear, or only the second and the third infuscated 3
3. Opercula reaching the apex of abdomen and wider on the disc of the apical area than at base; tegmina and wings hyaline *hainanensis*
   Opercula not reaching the apex of abdomen 4
4. Tegmina with the cross-veins of apical cells clear; opercula about reaching the penultimate segment of abdomen and uniformly ochraceous . . . . *larus*
   Tegmina with the cross-veins of the second and the third apical cell infuscated 5
5. Opercula extending to the sixth segment of abdomen and about as wide at base as on the disc of the apical area; tarsi black, size about 50 mm. . . . . *diana*
   Opercula passing the posterior margin of the sixth segment of abdomen and wider on the disc of the apical area than at base; posterior tarsi ochraceous; abdomen ochraceous with the apical half fuscous; size 40 mm. . . . . *kingvosana*

Platylomia kingvosana spec. nov.

Plate 5, Fig. 26

A large ochraceous species with prominent black markings on mesonotum as described below and the cross-veins of the second and the third apical cell infuscated. It appears to be very close to *diana* which is also described from Szechuan. But a number of structural characters make it distinct from all other members of this genus. The head only a little more than half as long as the space between eyes, pronotum definitely shorter than mesonotum (excluding cruciform

elevation), and abdomen only a little longer than the anterior half of the body. Furthermore, tympanal orifice exposed externally. It appears to stand between *Meimuna* and *Platylomia*, with the shape of the opercula closer to that of the latter.

Head deflected in front, with its length (5 mm.) only a little more than half as long as the space between the eyes (7 mm.) and about as wide as the base of mesonotum. Vertex ochraceous with the ocellar region and a large oblique fascia on the lateral area black and two small spots on the posterior margin fuscous. The two posterior ocelli separated by a deep sulcus where it is more or less reddish. The two lateral fasciæ more or less connected with the ocellar fascia. Tylus only a little wider than the anterior lateral margin of vertex and black with the base and a spot at the apex ochraceous.

Pronotum longer than head, only three-fourths as long as mesonotum (excluding cruciform elevation), distinctly narrowed anteriorly, sinuate and distinctly toothed laterally. Extreme posterior margin, central part of anterior margin, and the margins of the incisurial areas black. The inner margins of the two incisurial areas forming a central longitudinal lanceolate fascia on the disk. Lateral incisures and three spots (two large and one small) before the posterior angle fuscous.

Mesonotum ochraceous with three prominent fasciæ from the cruciform elevation black; the central one soon branching into three arms.

Abdomen only about one-seventh longer than the anterior half of the body, collapsed laterally, fuscous with tergites 3, 4, and 5 largely, and 6 partly ochraceous. Tympanal orifice slightly exposed on the inner angle. Flaps pale greenish. Anal tergite not visible. The lateral area (except a spot in the middle) of the third tergite rather thickly covered with silvery pile.

Tegmina and wings hyaline. Venation partly ochraceous and partly fuscous. Basal membrane blackish. Tegmina more than three times as long as wide with the cross-veins of the second and the third apical cells infuscated and a spot at the apex of radial area bright ochraceous. Basal cell a little more than twice as long as wide.

Body beneath ochraceous. Face moderately prominent, ochraceous, with a central longitudinal fascia brightly castaneous. A spot near antennal insertion, disc of lora, and streaks on coxæ blackish. Apex of rostrum, streaks on legs, and the anterior and middle tarsi dark fuscous or black. Abdomen pale ochraceous with the apical portion piceous. Genital plate dull ochraceous with the apical portion piceous.

Opercula ochraceous with the anterior part of the outer margin dark castaneous and two stripes on the disc blackish with the inner margin

convex and well separated, outer margin concavely sinuate near the base, and the posterior angles broadly rounded and reaching the seventh ventrite. Rostrum reaching nearly behind the posterior coxæ. Seventh ventrite narrowed posteriorly and rather deeply indented behind and a little longer than the preceding one. Genital plate lobate and projecting behind.

Body length 40 mm. Widest part of pronotum 15 mm. Length of tegmina 48 mm.

Holotype male from Mt. Kingfoo, Szechuan, Aug., 1932 in author's collection. Three paratypes from the same locality in Harvard collection. There is some color variation. In paler specimens, the black markings on mesonotum may be much reduced. Apical region of opercula sometimes piceous.

P. kingvosana virescens var. nov.

This variety differs from the typical form by being definitely green, entire outer margin of opercula black and the inner margin (except the basal part) piceous. This is evidently only a color variation.

Genus Meimuna Distant

Key to the Species

1. Tegmina hyaline with the cross-veins of the second and the third apical cell not infuscated; opercula in male straight on the inner side, narrowed to apices and reaching the middle of the fifth ventrite; abdomen dull sanguineous . . . . *tripurasura*
   Tegmina hyaline but with the cross-veins of the second and the third apical cell infuscated 2
2. Opercula hardly reaching the posterior margin of the third abdominal ventrite and rather sharply pointed at the apices *opalifera*
   Opercula passing beyond the posterior margin of the third abdominal ventrite and reaching at least two-thirds the length of the abdomen 3
3. Tympanal orifice not completely covered but with a slit on the inside; flaps longer than broad . . . . *neomongolica*
   Tympanal orifice completely covered, flaps as long as broad 4
4. Rostrum passing the posterior coxæ and about reaching the inner angles of opercula . . . . *mongolica*
   Rostrum just reaching the posterior margin of posterior coxæ *silhetana*

Meimuna opalifera Walker

Plate 5, Fig. 28

Reported from Peiping, Chekiang, Canton, Foochow, and Mt. Kingfoo.

Meimuna neomongolica spec. nov.

Plate 5, Fig. 27

This insect seems to be intermediate between *mongolica* and *silhetana*. In these three species, the markings on pronotum, mesonotum, and tegmina are all alike. The shape and the size of the opercula are also more or less similar. The present species is allied to *mongolica* in the size of the body and the markings on abdomen above. On the other hand, it resembles *silhetana* in the length of the rostrum, which reaches only as far as behind the posterior coxæ. It stands aloof from both species by having the tympanal orifice not completely covered. Furthermore, the tympanal flaps are definitely longer than broad.

Body above green or yellowish-green with black markings and sparingly pilose. Head declivous in front, shorter than the space between eyes, and wider than the base of mesonotum. Vertex green with the posterior margin of the eyes, a spot on the anterior lateral angle, and three large spots on the disc (the lateral ones angulate) black. Tylus black with the base and the lateral transverse stripes yellowish green and a spot at the apex ochraceous. Antennæ black. Eyes greyish brown and prominent. Ocelli shining red and about twice as far from the eyes as from each other. The two posterior ocelli separated by a deep sulcus where it is reddish.

Pronotum longer than head, about two-thirds as long as mesonotum (excluding cruciform elevation), narrowed anteriorly, sinuate and distinctly toothed laterally. Color green with the extreme posterior and lateral margins, margins of incisurial areas, and lateral incisures black. The inner margins of the incisurial areas forming a central longitudinal lanceolate fascia on the disc. Three spots near the posterior angle fuscous.

Mesonotum green with the anterior region more or less ochraceous and with five longitudinal black fasciæ from the anterior margin. The central one enlarged posteriorly and reaching the cruciform elevation. The sublateral ones reaching only the middle and slit. The lateral

ones much interrupted anteriorly. Two spots in front of the cruciform elevation black.

Abdomen (18 mm.) much longer than the anterior half of the body, reddish brown with markings on the anterior margins of tergites 2–6 dark fuscous, and the posterior margins green. The markings are similar to the markings as given by Distant in his figure for *mongolica.* Tympanal orifice is not completely covered but with a slit on the inner side. Flaps greenish and longer than broad. Eighth tergite pulverulent and about twice as long as the preceding one. Anal tergite small, much shorter than the genital plate, bisinuate behind, and greenish on the posterior margin.

Tegmina and wings hyaline with the base greenish. Tegmina more than three times as long as wide with venation partly brown and partly fuscous. Basal cell about three times as long as wide and wider at base. Cross-veins of apical cells 2 and 3 infuscated. Wings with the costal and the lower median vein greenish.

Body beneath paler. Face moderately prominent, black with the lateral striations green, and a spot at the base ochraceous. Cheeks black with the basal portion more or less greenish and the ridge of clypeus ochraceous. A large spot between face and eyes black. Rostrum ochraceous with the apex piceous. Legs greenish ochraceous with the streaks and tarsi piceous. Abdomen beneath with ventrites 2–4 pale piceous, 5–7 pale piceous with the anterior part darker. Genital plate ochraceous.

Opercula broad, moderately long, and reaching the middle of the fifth ventrite. Inner margins well separated, strongly convex about the middle, and then obliquely divergent posteriorly. Posterior inner margin nearly straight. Outer margin concavely sinuate near base and then strongly convex. Posterior angles bluntly pointed. Color slightly greenish with the outer marginal area (except the basal part) piceous. Rostrum reaching just behind the posterior coxæ. Seventh ventrite longer than the preceding one but shorter than the globose genital plate.

Body length 30 mm. Widest part of pronotum 10 mm. Tegmina length 38 mm.

Holotype male from Ichang, Hupeh, June, 1932, in author's collection. Paratype male from the same locality in Harvard collection. The paratype is paler and less greenish. The black area on the face is also greatly reduced.

Genus Pomponia Stal

Key to the Species

1. Abdomen about as long as the anterior half of the body; tegmina with cross-veins of the second and the third apical cell infuscated; rostrum just reaching the apices of the posterior coxæ..... *scitula*
   Abdomen much longer than the anterior half of the body........ 2
2. Tegmina with the cross-veins of the second and the third apical cell faintly infuscated; rostrum just reaching the apices of the posterior coxæ; opercula widely separated................. *thalia*
   Tegmina with numerous fuscous spots: rostrum extending far beyond the posterior coxæ and reaching the inner angles of opercula; opercula with the inner angles approaching............. *fusca*

Pomponia fusca Olivier

Plate 3, Fig. 17

Reported from Kwangtung and Kwansi.

Genus Oncotympana Stal

Key to the Species

1. Tegmina and wings moderately infuscated; rostrum passing posterior coxæ; cross-veins of apical cells 2, 3, 5, and 7 moderately infuscated; allied to *maculaticollis*..................... *fuscata*
   Tegmina and wings hyaline............................... 2
2. Abdomen with the posterior margin of tergites 2 and 3, tympanal coverings, disk beneath, and opercula pale bright virescent; tegmina with cross-veins of apical cells 2, 3, 5, and 7 broadly piceous.................................... *virescens*
   Abdomen with the corresponding parts not so marked; tegmina with cross-veins of apical cells 2, 3, 5, and 7 infuscated; cross-vein of the eighth apical cell at most with only the lower angle slightly fuscous...................................... 3
3. Tegmina without a series of submarginal fuscous spots, body beneath pale ochraceous............................ *coreana*
   Tegmina with a series of submarginal fuscous spots............ 4

4. Opercula either entirely black or with the posterior margin black; size of the body at least 30 mm. long............ *maculaticollis*
   Opercula ochraceous; size of body 26 mm. long; allied to *virescens* but rostrum longer, opercula shorter, and color different. *stratoria*

Oncotympana maculaticollis Motschulsky

Plate 3, Fig. 16

Known from Shantung, Kansu, Szechuan, and Hangchow; taken at Chungking, Mt. Omei, Mt. Kingfoo, and Mt. Chingchen, all in Szechuan.

Key to the Varieties

1. Opercula bicolorous, very close to the typical form....... *variety d*
   Opercula concolorous...................................2
2. Opercula ochraceous....................................3
   Opercula black...4
3. Larger forms with the ochraceous area on mesonotum much reduced; ground color of the body ochraceous........... *variety b*
   Smaller forms with the ochraceous area on mesonotum reduced to small spots; ground color of the body black............ *coreana*
4. Abdomen above with a transverse white fascia behind the tympanal coverings.................................. *variety a*
   Abdomen above without such white fascia, but uniformly black with two spots on the first segment, and the posterior margin of the second segment ochraceous........................ *variety c*

Variety A

This variety differs from the typical form, besides those mentioned in the key with regard to the color of the opercula, in having the ochraceous area on mesonotum reduced to 10 spots. Abdomen beneath entirely black with the posterior margin of the penultimate segment and the pleurites of the third and fourth segment ochraceous. Abdomen above with a white transverse fascia on the second segment.

Variety B

This variety differs from the typical form and other varieties by having the opercula entirely ochraceous and from *coreana* by being larger and paler.

Variety C var. nov.

This variety differs from other forms by the absence of a white fascia on the abdomen and by having the color smoky. Only one male specimen from Mt. Kingfoo, Szechuan.

Variety D var. nov.

This variety is very close to the typical form and differs from it by having the fuscous area on opercula much enlarged, abdomen beneath more or less fuscous, and the ochraceous area on mesonotum reduced to ten spots. A large number of specimens in Harvard collection.

Variety COREANA Kato

After examining a large number of *O. maculaticollis* and noting its variation, one comes to the conclusion that Kato's *coreana* can be regarded only as a variety of this species. (cf. KATO, *Trans. Nat. Hist. Soc. Formosa,* **15**, 1925, p. 27.)

Genus TERPNOSIA Distant

Key to the Species

1. Opercula in male extending beyond the posterior margin of the second abdominal ventrite; tegmina with two series of fuscous spots, the inner one on the cross-veins of the apical cells and the outer one submarginal . . . . *ichangensis*

   Opercula not extending beyond the posterior margin of the second abdominal ventrite; tegmina without a submarginal series of fuscous spots 2
2. Abdomen above black with three brown spots on each side; tegmina with the cross-veins of the second and the third apical cell infuscated; opercula short and black . . . . *obscura*

   Abdomen above either ochraceous or greenish ochraceous with or without black markings; opercula not entirely black 3
3. Tegmina with the apical veins to the second and the third ulnar area infuscated; abdomen above virescent with a double discal segmental series of large black spots . . . . *mawi*

   Tegmina with cross-veins of apical cells 2, 3, and 5 infuscated . . . 4
4. Abdomen above with an oblique submarginal linear broken fuscous fascia; opercula subquadrate and without a basal black fascia. *andersoni*

   Abdomen without any fuscous fascia; opercula obliquely rounded, somewhat elongate, and with a basal black fascia . . . . *clio*

Terpnosia andersoni Distant

Plate 6, Fig. 36

Described from Yunnan.

Terpnosia obscura spec. nov.

Plate 6, Fig. 42

This *Terpnosia* can be easily separated from other species by the color of the body above, which is black. Tegmina with venation black and the cross-veins of apical cells 2 and 3 infuscated.

Body above black. Head declivous in front, shorter than the space between eyes, and about as wide as, or wider than, the base of mesonotum. Crown black with some obscure and ill-defined spots and short stripes. Antennæ black. Eyes greyish brown with series of black spots and short stripes. Ocelli shining red and less than twice as far from eyes as from each other.

Pronotum a little shorter than mesonotum (excluding cruciform elevation), as long as head, a little more than twice as wide as long, with the lateral margins deeply sinuate in the middle and the posterior angles ampliated. A well defined but rather obscure central longitudinal fascia, a large spot on anterior lateral angle, and a large spot near the posterior angle reddish testaceous. Mesonotum black with four oblique and obscure reddish fasciæ from the anterior margin. Two small circular spots in front of the cruciform elevation pitchy black. Cruciform elevation reddish brown.

Abdomen (15 mm.) about one-third longer than the anterior half of the body, black with the following markings reddish:—two spots on the anterior margin of the second segment, a transverse stripe on the basal part of tympanal flaps, two large spots (the outer one ill-defined) on each side of tergites 3–5, an obscure spot on the fifth tergite, and the posterior margin of tergites 3–6. Eighth tergite suddenly constricted with the posterior half densely covered with short silvery pile. Anal tergite prominent, cleft behind with the two lateral parts produced into sharp spines pointed upward.

Tegmina and wings hyaline. Venation fuscous. Tegmina three times as long as wide with the cross-veins of apical cells 2 and 3 and the apical part of the marginal vein of anal area infuscated. A spot at the apex of radial area ochraceous. Basal cell twice as long as wide. Venation of wings blackish brown with the lower median, the cubital, and the anal vein black.

Body beneath piceous with the anterior half more thickly pilose. Face moderately prominent, oblong, and black with the lateral area paler. Lateral striations not distinct. The region between the face and eyes, disc of lora and clypeus, apex of rostrum, opercula, and base of abdomen black. Legs reddish brown with streaks of various shades of castaneous. Apices of femora and bases of tibiæ ochraceous. Abdomen beneath pale piceous.

Opercula not reaching the posterior margin of the second abdominal ventrite with the outer margin slightly convex, posterior margin slightly oblique and nearly straight, and the inner margins well separated. Rostrum just reaching the posterior coxæ. Seventh ventrite depressed on the posterior part of the disc, concave on the posterior margin, longer than the preceding one but shorter than the genital plate.

Body length 26 mm. Tegmina length 25 mm. Widest part of pronotum 7 mm.

One male from Wuchang, Hupeh, May, 1932, in author's collection.

Terpnosia ichangensis spec. nov.

Plate 6, Fig. 43.

This insect is chiefly characterized by the two series of fuscous spots on tegmina and by the length of opercula which extend beyond the second abdominal ventrite. In general appearance, size, and also more or less the markings on the tegmina, it closely resembles *nigrocosta* Motschulsky from Japan (Distant, *Mon. Orient. Cicad.*, 1892, p. 138).

Body pale reddish brown and covered with silvery pile. Head declivous in front, as long as the space between eyes, and a little narrower than the base of mesonotum. Vertex suffused with piceous red and with two ill-defined transverse black fasciæ (more or less connected laterally). The anterior one enlarged laterally but does not extend to the lateral margin. The posterior one fainter and more or less interrupted. An ill-defined transverse fascia behind the ocelli greenish ochraceous. Tylus suffused with red and with a reddish ochraceous central fascia extending to the face. Antennæ castaneous. Eyes brown, prominent, and projecting. Ocelli shining red and more than twice as far from the eyes as from each other.

Pronotum a little more than twice as wide as long, longer than head, shorter than mesonotum (excluding cruciform elevation), distinctly

narrowed anteriorly, and with the lateral margins indented at the middle, and ampliated both at the posterior and anterior angles. The marginal area, a central longitudinal lanceolate fascia, and four more or less ill-defined short fasciæ on the disc reddish ochraceous. Two central longitudinal fasciæ (enlarged and connected both anteriorly and posteriorly), extreme margins (except the posterior angle), and the outer margin of the incisurial areas more or less dark castaneous. Incisurial areas paler.

Mesonotum greenish ochraceous with seven longitudinal fasciæ from the anterior margin dark castaneous. The central one slender and reaching the cruciform elevation. The next two convergent, enlarged posteriorly and hook-like, and reaching only as far as the middle, the third pair very short, the outermost pair prominent, enlarged and forked posteriorly, and reaching the cruciform elevation.

Abdomen (18 mm.) one-third longer than the anterior half of the body and reddish brown with the lateral areas paler. Eighth tergite suddenly constricted, as long as the preceding one, castaneous with the posterior half paler. Anal tergite as long as the preceding one, reddish brown with a castaneous spot on each side, produced into a dorsal spine posteriorly.

Tegmina and wings hyaline. Tegmina more than three times as long as wide. Venation partly ochraceous and partly fuscous with a spot at the apex of radial area bright. Costal membrane greenish ochraceous. Basal cell longer than broad. Cross-veins of apical cells 2, 3, 4, 5, and 7 infuscated. A series of submarginal spots fuscous. Venation of wings fuscous with the basal part of the lower median vein ochraceous.

Body beneath paler with the anterior half reddish. Face moderately prominent, dark castaneous with the lateral transverse stripes, a central longitudinal fascia, and the lateral margins reddish ochraceous. Clypeus dark castaneous with two spots on the ridge reddish ochraceous. A large spot between the face and the eyes and the disc of lora black. Apex of rostrum castaneous. Legs reddish with the apices of femora ochraceous. Abdomen beneath pale ochraceous with the last segment and the genital plate darker.

Opercula with the posterior angle extending just beyond the posterior margin of the second abdominal ventrite. Outer margin slightly convex. Posterior margin oblique and nearly straight. Inner angles well separated. Rostrum reaching behind the posterior coxæ. Seventh ventrite slightly sinuate behind, wrinkled on the posterior half of the disc, longer than the preceding one but as long as the genital plate.

Body length 31 mm. Tegmina length 33 mm. Widest part of pronotum 9 mm.

One male from Ichang, Hupeh, in Harvard collection.

Genus Lycurgus China

Lycurgus subvitta Walker

Plate 6, Fig. 35

Recorded in Wu's Catalogue from "China."

Genus Gæana Amyot and Serville

Key to the Species

Rostrum reaching just behind the middle coxæ; black with the apical part dark fuscous; wings with basal half stramineous and the remaining area dark fuscous but without a series of submarginal spots . . . . *vestita*

Rostrum reaching posterior coxæ, tegmina black with the apical region paler, wings black with a basal patch and a series of submarginal spots ochraceous . . . . *maculata*

Gæana maculata Drury

Plate 2, Fig. 11

Taken at Kweiping, Kwansi; known from many places in China.

Gæana maculata consors Walker

This variety differs from the typical form in the color of tegmina and wings being replaced by pale greenish, and also by the size of the basal spot on wings, which occupies nearly half the area. It also has two ochraceous stripes on the posterior margin of the seventh ventrite and does not have the ochraceous spots on the lateral margin of mesonotum. The female also has two series of reddish spots on abdomen beneath.

The material at hand came from Lamin, Assam.

G. maculata barbouri var. nov.

This variety is characterized by being entirely pale reddish brown with the anterior half of the body castaneous and by the absence of

ochraceous markings on the seventh ventrite. Tegmina and wings pale brown with venation reddish. The basal patch on wings greatly reduced. Posterior margins of abdominal tergites 3–7 (except on the lateral areas and the last segment) concolorous in the middle. Two Chinese specimens in Harvard collection. This variety is dedicated to Dr. Barbour, director of the Museum of Comparative Zoölogy at Harvard College.

G. maculata distanti var. nov.

Plate 2, Fig. 12

This variety is characterized by the presence of a series of faint short transverse narrow bands on abdomen beneath and by having tegmina and wings piceous with prominent black venation. Basal patch of wings greatly reduced. One male specimen from Hongkong.

Genus Mogannia Amyot and Serville

Key to the Species

1. Body and legs brightly shining indigo-blue; head strongly pilose. *cyanea*
   Body and legs not indigo-blue 2
2. Tegmina with the basal third more or less irregularly suffused with greenish or ochraceous but without any traces of fuscous; body and legs pale greenish or ochraceous . . . . *hebes*
   Tegmina with the basal half either shining black, fuscous, or with a broad transverse fascia which is more or less margined with fuscous 3
3. Tegmina with a broad transverse fascia which is ochraceous, oblique, widened posteriorly, more or less margined with fuscous, and across the end of the radial area to the inner margin; body and legs pale castaneous and pilose . . . . *nasalis*
   Tegmina with the basal half either fuscous or shining black; body and legs black 4
4. Tegmina with the basal half fuscous and semi-opaque, extending from the end of the radial area to a little beyond the apex of the interior ulnar area; body above with a more or less defined and broken longitudinal central fascia extending from the apex of head to the apex of abdomen . . . . *conica*

Tegmina with the basal half shining black, containing a transverse hyaline fascia which occupies the basal half of the radial area and terminating beneath the basal cell; body above with a broad central longitudinal fascia but not extending to the apex of head. *mandarina*

Mogannia cyanea Walker

Plate 6, Fig. 32

Occurs at Yungshien, Kwansi; known from North China.

Mogannia cyanea yungshienensis var. nov.

Plate 6, Fig. 33

This variety differs from the typical form in having the fuscous band in the middle of the tegmina extending to the posterior margin and connected with the basal fuscous area by a narrow fuscous band on the claval margin. Costal vein and costal membrane also fuscous. Apical third of tegmina pale smoky. Abdomen above without tufts of white hairs. The color of the body is variable, one of the specimens looks dark sanguineous on the front of the head, the posterior legs, and the anterior femora.

Three females from Yungshien, Kwangsi, May, 1933.

Mogannia hebes Walker

Plate 6, Fig. 34

Described from North China; occurs as far south as Canton, and west to Mt. Omei, Szechuan.

Genus Huechys Amyot and Serville

Key to the Species

Pronotum with a distinct central fascia .... *hæmatica*
Pronotum concolorous .... *sanguinea*

Huechys sanguinea Degeer

Plate 6, Fig. 29

Known from Canton, Macao, and Yungshien, Kwansi; and Hangchow and Soochow, also Ichang, Hupeh.

H. SANGUINEA PHILÆMATA Fabricius

This variety differs from the typical form in the color of tegmina, which are fuscous but not black. The wings are also paler but occasionally may be more fuscous than the wings of the typical form. Two specimens from Wuchow and two from Yungshien.

H. SANGUINEA var. B Distant

This variety is characterized by the presence of greyish streaks on the apical and the ulnar area of tegmina. The number and size of these streaks vary among different specimens; sometimes they may be reduced to a few spots and sometimes present a series of longitudinal stripes. Distant points out that the wings are blackish with greyish white streaks. The wings of the specimen on hand are smoky or blackish but show no sign of these greyish streaks. Three specimens from Yungshien, one from Foochow, one Tonking, two in Harvard collection without definite locality except "China." Both Foochow and Tonking are new records for this species.

H. SANGUINEA WUCHANGENSIS var. nov.

Very close to *philæmata* but differing in having the middle femora much darker or almost black while the anterior and the posterior ones bright castaneous. Tegmina still paler. Head and mesonotum black except the regular sanguineous spots of the species. Pronotum, sternites, opercula, and anal segment of abdomen ochraceous. The insect is smaller and more slender than the typical form or other varieties. Only one male specimen from Wuchang, Hupeh. This is also a new record for this species.

H. SANGUINEA OCHER var. nov.

In this variety, the sanguineous part of the body of the species is replaced by ochraceous. Tegmina black with a few greyish white spots. Size larger and more robust. One female from Foochow, Fukien.

HUECHYS HÆMATICA Distant

Plate 6, Fig. 30

Occurs at Yungshien, Kwansi, and others labelled "China."

Genus Scieroptera Stal

Scieroptera splendidula Fabricius

Plate 6, Fig. 31

Occurs at Pingloo, Kwansi; others labelled "China."

Genus Lisu gen. nov.

This genus in general appearance, resembles some of the *Pomponia* in *Cicadinæ*. According to the form of its abdomen, it is closer to the *Chlorocystini* but the texture of tegmina and the form of the genital appendages favor its association with the present tribe. Here it differs from all other members of the tribe by the form of pronotum, which is narrowed gradually toward the head, by the color of the base of wings and tegmina, which is not sanguineous, and also by the length of the crown, which is longer than broad. The eyes are also very prominent and together about as wide as the space between them. It is very close to the American *Okanagana* (*Ann. Mag. Nat. Hist.*, **16**, 1905, p. 23).

Head including eyes narrower than the base of mesonotum (excluding cruciform elevation), much longer than the space between eye, and shorter than pronotum. Pronotum distinctly narrowed anteriorly. Abdomen slightly longer than the anterior half of the body, more or less triangular with a broad dorsal central longitudinal ridge and with the anal appendages prominent. Tegmina about three times as long as wide, talc-like, wrinkled, and with eight apical cells. Opercula very small and narrow. Anterior femora spined beneath. Tympanal orifice completely exposed. Type species *L. neokanagana* spec. nov.

This new genus is close to *Okanagana* in the sulcation of the face, the size and shape of opercula, the relative length of rostrum, the relative length of the tylus of head, the relative length of the basal cell of tegmina, and also by the construction of the anterior lateral margin of vertex over the antennæ.

The genus is dedicated to Lisu who was one of the best Chinese entomologists in the sixteenth century.

Lisu neokanagana spec. nov.

Plate 6, Fig. 41

This cicada can be easily recognized by the form of the body, which is moth-like, and by the tegmina which are greenishly tinged, wrinkled, and talc-like. The body attenuated both anteriorly and posteriorly.

Body sparingly covered with silvery pile with the anterior half yellowish green and the abdominal section brownish. Head much narrower than the base of mesonotum, longer than the space between eyes, and shorter than pronotum. Vertex a little longer than broad with the anterior lateral margin almost conically dilated. Color yellowish green with the ocellar region and some stripes on the lateral area black or fuscous. Tylus yellowish green with the anterior margin fuscous. Eyes rusty brown, very prominent, and almost as wide as the space between them. Ocelli prominent and as far from the eyes as from each other.

Pronotum as long as mesonotum (excluding cruciform elevation), deflected laterally, ampliated at posterior angles, and gradually narrowed anteriorly. A longitudinal sulcus extending from the anterior half over the crown to the face beneath. Color yellowish green with the posterior angles, two stripes on the lateral marginal area, the lower part of the incisurial areas and a large stellate central spot on the posterior half of the disk more or less fuscous. The stellate spot much darker.

Mesonotum yellowish green with four large obconical fasciæ from the anterior margin, two small spots in front of the cruciform elevation, and a large spot on the disc of cruciform elevation fuscous.

Abdomen (12 mm.) as long as the anterior half of the body, compressed laterally, gradually attenuated posteriorly, constricted suddenly in the middle of the eighth segment, and with the anal appendages prominent. Color brownish, more thickly covered with silvery hairs, and four series of fuscous spots on each side. The lower three spots on the second tergite fused to form a transverse fascia. Eighth tergite with the anterior half glabrous, slightly indented in the middle of the posterior margin, and twice as long as the preceding one. Anal tergite deeply excavated behind with the two lateral lobes encircling the genital organ, and extending not as far as the genital plate beneath.

Tegmina three times as long as wide, greenish-tinged, talc-like, wrinkled, and with a series of six fuscous spots in front of the ambient vein. Venation brown. Costal membrane fuscous. Basal cell elongate and wider at base. Basal membrane blackish with the lower margin reddish. Wings hyaline with venation ochraceous. Margin of anal area and veins of claval area more or less pale fuscous.

Body beneath dull ochraceous. Face moderately prominent with the anterior half obliquely deflected, longitudinally sulcate in the middle, and yellowish green with the lateral transverse striations fuscous.

Antennæ fuscous and inserted in a hood formed by the anterior lateral margin of vertex. Lateral margin of the cheek, rostrum, legs, thoracic parts beneath, opercula, and abdomen beneath ochraceous. The abdominal part, except the genital plate, darker. The region between the face and eyes, annulation and spots on legs, two spots on mesosternite and some spots on abdominal ventrites more or less fuscous. The two mesosternal spots large, darker, and prominent. Anterior femora beneath provided with three spines.

Opercula short, narrow, and more or less pointed. Outer margin oblique and slightly sinuate near base. Rostrum reaching the middle coxæ. Seventh ventrite attenuated posteriorly, rounded behind, and twice as long as the preceding one. Genital plate longer than the preceding two united.

Body length 25 mm. Tegmina length 33 mm. Widest part of pronotum 9 mm.

One male specimen from Mt. Chingchen, Kuanshien, Szechuan, July, 1932, in the author's collection.

Genus Melampsalta Kolenati

Key to the Species

1. Tegmina with cross-veins of the second and the third apical cell infuscated; pronotum sinuate and angulate laterally... *bifuscata*
   Tegmina with the cross-veins of apical area not infuscated; pronotum not angulate laterally.......................... 2
2. Mesonotum ochraceous with four obconical black fasciæ from the anterior margin; abdomen more or less ochraceous with the posterior segmental margins not distinctly marked... *pellosoma*
   Mesonotum not so colored and marked; abdomen with the posterior segmental margins usually differently marked......... 3
3. Mesonotum with five longitudinal fasciæ (the central one narrow and the lateral four broad); abdomen with posterior half of each segment above yellowish red and the eighth tergite as long as the preceding two united...................... *neocruentata*
   Mesonotum and abdomen not so colored and marked......... 4
4. Abdomen above dull black with the lateral area more or less dull yellowish; opercula with the base fuscous, head black with an olivaceous spot at the apex of tylus................ *isshikii*
   Abdomen above black with the posterior segmental margins variously marked................................... 5

5. Mesonotum ochraceous with the disc of cruciform elevation black; the lateral margins and two discal spots reddish ochraceous. Head black with a reddish ochraceous spot on the posterior margin . . . . *inglisi*
   Mesonotum black with a few spots, head black with the anterior lateral margin usually colored 6
6. Pronotum with the central longitudinal fascia enlarged posteriorly 7
   Pronotum with the central longitudinal fascia not enlarged posteriorly 8
7. Abdomen above with the central portion of posterior segmental margins reddish; opercula black; pronotum with the anterior and the posterior margin reddish . . . . *megerlei*
   Abdomen above with the posterior segmental margins reddish; opercula reddish; a short longitudinal fascia on pronotum, some spots on head, and two small spots on mesonotum reddish. *dimissa*
8. Pronotum with the central longitudinal fascia enclosing two small black spots; opercula piceous with the margins testaceous. *mogannia*
   Pronotum with the central longitudinal fascia enclosing one black spot in the enlarged part 9
9. Mesonotum with two central longitudinal fasciæ, each enclosing a black spot; head with the apical margin of the tylus and the anterior lateral margin of vertex testaceous . . . . *soulii*
   Mesonotum with only two small spots 10
10. The length of the fusion of the veins more than half as long as the basal cell of tegmina which are nearly straight on the anterior margin; head including eyes narrower than the base of mesonotum and about half as long as wide (including eyes) . . . . *wulsini*
    The length of the fusion of the veins very short, at most about one-fifth as long as the basal cell, sometimes the radial vein and the ulnar vein only approaching. Tegmina with the anterior margin more or less convex; head including the eyes about as wide as the base of mesonotum and less than half as long as wide (including eyes) . . . . *radiator*

Melampsalta neocruentata spec. nov.

Plate 6, Fig. 37

In general appearance, color and markings of body above, and shape and size of opercula, this cicada is very close to *cruentata* Fabricius from New Zealand (*vide* Stal, *Hem. Fab.* **2**, 1869, p. 116). However, it can be readily separated by the following characters. Size larger, wings more elongate, penultimate abdominal segment longer than the preceding two united, genital plate larger and more broadly rounded posteriorly, and abdomen above without a longitudinal central dorsal line of silvery pile.

This is a small reddish cicada and covered thickly with appressed silver pile. General form of the body truncate in front and pointed behind. It can be separated from other related species known to occur in China by the presence of five black longitudinal fasciæ on mesonotum and two circular small spots in front of cruciform elevation.

Head declivous in front, shorter than the space between eyes, and wider than the base of mesonotum. Vertex black with the anterior lateral margin and a spot on the posterior margin reddish. The anterior lateral margin slightly ridged and upwardly convex. Tylus small, only a little wider than the anterior lateral margin of vertex, and black with the anterior margin and a central longitudinal fascia reddish. Antennæ black. Eyes greyish brown and speckled anteriorly. Ocelli shining red and about as far from the eyes as from each other.

Pronotum deflected laterally, dilated at the posterior angle, longer than head, as long as mesonotum including the cruciform elevation, reddish with a median spot in front of the posterior margin; an ill-defined spot on the posterior angle, and the lateral incisurial areas black or dark fuscous. The black area on the incisurial disc broken. A longitudinal sulcus extending from pronotum over crown to face beneath.

Mesonotum reddish with the following markings black: four broad and large obconical fasciæ from the anterior margin, a central and slender fascia from the cruciform elevation, and two small circular spots in front of cruciform elevation. The two lateral fasciæ extend to the anterior arms of the cruciform elevation which is fuscous.

Abdomen (8 mm.) about as long as the anterior half of the body (or slightly longer), gradually attenuated posteriorly, and with the tympanal orifice entirely exposed. Eighth tergite longer than the preceding two united and the anal tergite produced into a strong spine behind. The predominant color of abdomen above is black but nearly the posterior half of each segment (except the first one) reddish.

Tegmina hyaline and about three times as long as wide. Venation greenish ochraceous with the apical half fuscous. Basal cell much longer than wide and wider at base. The fusion of the radial vein with ulnar vein about two-thirds as long as the basal cell. Basal membrane reddish. Wings hyaline. Venation ochraceous with apical half fuscous.

Body beneath reddish. Face reddish with transverse lateral striations black. Antennæ, cheeks, the region between face and eyes, and a large spot in the middle of the first two abdominal segments beneath black. Rostrum, tibiæ, tarsi, and femora of anterior legs, streaks on anterior coxæ, and streaks on middle and posterior legs castaneous. Bases of opercula piceous. Opercula, genital plate, lateral area of the second abdominal ventrite, lateral areas of the sternites, and lateral stripes on anterior coxæ and femora more or less slightly reddish ochraceous. Abdomen beneath reddish.

Opercula short, widely separated, with the outer margin sinuate near base, posterior margin slightly convex, and the inner angles rounded. With the specimen on hand, the posterior margin does not reach the second abdominal ventrite. Rostrum just reaching the middle coxæ. Genital plate about as long as the preceding one, elongate-ovate, and not projecting beyond the appendages as it is in *cruentata*.

Body length 17 mm. Tegmina length 20 mm. Widest part of pronotum 5 mm.

One male specimen from Mt. Kiuhua, Anhwei, 1932, in author's collection.

Melampsalta bifuscata spec. nov.

Plate 6, Fig. 40

This cicada is evidently allied to the European species, *M. adusta* Hagen, by the infuscation of the first two cross-veins of tegmina (Melichar, *Cicad. Mit.-Eur.*, 1896, p. 9). According to Melichar's description, the markings on the mesonotum also seem to be similar. But the most remarkable character of this new species is the angulation of the lateral margins of pronotum.

A small black cicada, covered with erect long hairs and with the first two cross-veins of tegmina infuscated. Head declivous in front, about as long as the space between eyes, and narrower than the base of mesonotum. Vertex black with an ochraceous spot before the middle of the posterior margin. Tylus black with an ochraceous spot at the apex and only a little wider than the anterior lateral margin of vertex.

Antennæ black. Eyes brown. Ocelli shining red and about as far from the eyes as from each other.

Pronotum longer than head, shorter than mesonotum (including cruciform elevation), a little narrowed anteriorly, ampliated at the posterior angle, and strongly angulately produced in the middle of the lateral margin. Color entirely black with the posterior margin reddish, an anterior central longitudinal short fascia, and three small spots arranged in a triangle before the middle of posterior margin ochraceous. Mesonotum black with the following markings ochraceous:—anterior lateral margin, posterior margin, two small angulate spots on the disc, and the lateral arms of cruciform elevation.

Abdomen (10 mm.) a little longer than the anterior half of the body, pointed behind, and entirely black with the posterior margins of the segments above (except the first two) narrowly ochraceous. Tympanal orifice entirely exposed. Eighth tergite about as long as the preceding two united. Anal tergite produced behind into a strong spine.

Tegmina hyaline, less than three times as long as wide, and the first two cross-veins of apical area infuscated. Costal membrane warm ochraceous. Basal membrane red. Venation greenish ochraceous with the apical half fuscous. Basal cell about twice as long as wide and wider at base. The fusion of the radial vein with ulnar vein very short, not more than one-fifth as long as the basal cell. Wings hyaline. Venation fuscous. Margins and veins of claval area more or less infuscated. The base of the fourth apical cell also infuscated.

Body beneath black and more longly pilose. Lateral margin of face, streaks on femora, margins of pro- and mesopleurites, margins of coxal cavities, and the posterior margins of abdominal ventrites (except the first one and the seventh one) more or less red. Apex of coxæ, femora, and tibiæ ochraceous. Opercula with the basal half piceous, the apical half reddish, and the marginal area paler. Rostrum black with the base paler.

Opercula about reaching the posterior margin of the second abdominal ventrite with the outer margin sinuate near base, posterior margin convex, and inner angles rounded. Rostrum just passing the middle coxæ. Seventh ventrite depressed on the disc of the posterior third and longer than the genital plate.

Body length 21 mm. Tegmina length 25 mm. Widest part of pronotum 8 mm.

One male specimen from Ta-tsien-lu, Szechuan, Aug. 31, 1905, in Harvard collection.

Melampsalta radiator Uhler

Plate 6, Fig. 39

From Mukden, Manchuria and Shoutsu, Corea.

Melampsalta wulsini spec. nov.

Plate 6, Fig. 38

Superficially speaking, this small black cicada is very similar to *M. radiator.* This is especially true with regard to the size, general color, and the markings of the body, both above and beneath. The claval vein of the wings also infuscated. But it can be separated easily by a number of structural differences. For instance, in this new species, the head including the eyes is much narrower than the base of mesonotum, the fusion of the radial vein with ulnar vein is much longer than the apical cross-vein of the basal cell, the genital plate is globose, and the seventh ventrite is much shorter than the preceding three united. In *radiator,* the genital plate is more or less elongate.

Head declivous in front, shorter than the space between eyes, and narrower than the base of mesonotum. Vertex black with a spot before the middle of the posterior margin and the anterior lateral margin reddish ochraceous. Anterior lateral margin a little convex. Tylus black with a central longitudinal fascia reddish ochraceous. Eyes brown. Ocelli dull red and about as far from the eyes as from each other.

Pronotum longer than head, about as long as mesonotum (excluding cruciform elevation), narrowed anteriorly, deflected laterally, and ampliated at the posterior angle. Color entirely black with the anterior and posterior margins, a central longitudinal fascia (not reaching the margins in both directions and a little constricted on posterior third), and two angular spots before the posterior margin reddish ochraceous. The lateral marginal area more or less piceous.

Mesonotum entirely black with the anterior lateral margin, two small angulate spots on the disc, and the lateral arms of cruciform elevation reddish ochraceous. Posterior lateral margins piceous.

Abdomen (11 mm.) as long as the anterior half of the body, gradually attenuated posteriorly, and the tympanal orifice entirely exposed. Anal tergite produced into a strong spine. Eighth tergite shorter than the preceding two united. Color of abdomen above entirely black with the posterior margins of tergites 3–8 very narrowly ochraceous. Anal tergite black with the lateral areas ochraceous.

Tegmina and wings hyaline. Tegmina less than three times as long as wide with the anterior margin nearly straight. Costal membrane brown. Post-costal membrane piceous. Basal membrane reddish. Basal cell about theee times as long as wide. The fusion of the radial vein with ulnar vein is about two-thirds as long as the basal cell. Apical cells eight. Venation reddish ochraceous with the apical half fuscous. Wings with the veins and margins of the claval area infuscated. Venation reddish ochraceous with the apical half fuscous.

Body beneath ochraceous. Face black, deeply and longitudinally sulcate in the middle with a spot at base and the lateral and anterior margins ochraceous. Spots between the face and eyes, disc of cheeks, longitudinal streaks on legs, mesosternite, base of opercula, and a large spot in the middle of the second abdominal ventrite, black. Rostrum and the four median spots on abdomen beneath piceous.

Opercula not reaching the posterior margin of the second abdominal ventrite with the outer margin sinuate near base, posterior margin convex, and the angles rounded. The general shape of opercula is similar to that of *M. radiator*, but the posterior margin more convex and the inner angles less pointed. Rostrum just passing the middle coxæ. Seventh ventrite shorter than the preceding three united. Genital plate globose.

Body length 21 mm. Tegmina length 25 mm. Widest part of pronotum 8 mm.

Holotype male from Hung Djen Djun, Shansi, in Harvard collection. This insect is dedicated to its collector, Prof. Wulsin of Harvard.

Four Other New Oriental Species

Platypleura intermedia spec. nov.

These insects combine the characters of *P. subrufa* Walker (Distant, *Mon. Orient. Cicad.* 1892, p. 9) and *P. octoguttata* Fabricius. The markings of the tegmina are those of the latter while the prominent lateral angulation of the pronotum and the markings of the body above are similar to those of the former. There are also two small spots on the pronotum as in *octoguttata* but very obscure.

Body length 27 mm. Widest part of pronotum 15 mm. Tegmina 34 mm.

Holotype male from Poffua, Ceylon. Two paratypic males from the same locality.

Pycna minor spec. nov.

Plate 1, Fig. 5

Markings on the tegmina and wings very close to *P. repanda* but differing from it by having the anal area of the wing entirely ochraceous, rostrum reaching the posterior margin of opercula, size much smaller, and body thickly covered with long hairs.

Head strongly declivous in front, three-fifths as long as the space between the eyes, and including the eyes a little narrower than the base of mesonotum. Vertex long pilose, suffused with brown, longitudinally sulcate in the middle, and with a faint darker transverse fascia between the eyes. Tylus with the anterior margin paler. Antennæ brown. Eyes dark grey, shining, and embedded between the lateral margins of the pronotum and the anterior lateral margin of vertex. Ocelli shining red and about twice as far from the eyes as from each other.

Pronotum dull brown with an obscure central longitudinal fascia and the lateral marginal areas darker, slightly longer than the head, shorter than mesonotum, nearly three times as wide as long, and with the lateral margins ampliated and angulated in the middle. Mesonotum dull brown with the faint markings more or less similar to those of *repanda*, namely; four obconical broad fasciæ from the anterior margin (the middle two shortest and the lateral two reaching the cruciform elevation) and a central longitudinal pointed fascia from the cruciform elevation reaching almost to the anterior margin.

Abdomen shorter than the anterior half of the body, abruptly pointed behind, with the eighth tergite longer than the preceding one and the anal tergite sharply pointed; long pilose; black with the posterior margins of tergites 3–5 paler. Anal tergite shining. Tympanal orifice completely covered. Flaps piceous.

Tegmina nearly three times as long as wide. Costal membrane dilated and arched. Basal cell broadly triangular. Venation greenish-ochraceous with the apical half warm ochraceous. Basal membrane blackish with the posterior margin white. Markings as shown in the figure. Wings ochraceous with the apical margin hyaline and a large apical spot fuscous.

Body beneath paler and long pilose. Face longitudinally sulcate in the middle, the lateral transverse striations pale. Legs and rostrum reddish brown. Opercula and abdomen beneath pale castaneous. Margins of opercula paler.

Rostrum passing the posterior coxæ, but far from the posterior

margin of the opercula. Opercula broad and transverse, passing a little over the second ventrite with the outer margin convex, posterior margins slightly oblique and convex, and the inner angles overlapping. Seventh ventrite broadly triangular, sunken and wrinkled on the posterior two-thirds, and longer than the preceding two united. Lateral areas of the eighth tergite pulverulent.

Body length 19 mm. Widest part of pronotum 11 mm. Tegmina length 29 mm.

Holotype male from Koolloo, India (Carleton). Paratypes one male and three females from the same locality.

While the characters in *repanda* tend to be variable, those in the present species are apparently constant.

Platylomia maculata spec. nov.

A large cicada, uniformly dark castaneous, body above and the anterior half beneath thickly pilose, abdomen beneath glabrous. Closely allied to *P. ficulnea* Distant (*Mon. Orient. Cicad.*, 1892, p. 102), especially by the markings of the tegmina, which are similar in both, but differing from it by the shape and length of the opercula, the length of the rostrum, shape and opacity of the basal cell, the prominence of the eyes, etc.

Head declivous in front, shorter than the space between eyes, wider (including eyes) than the base of mesonotum, and with the lateral markings more or less in a straight line with the eyes. Eyes prominent, projecting, and with the posterior margin fringed with long hairs. Ocelli shining red and more than twice as far from the eyes as from each others. Tylus fairly prominent.

Pronotum longer than head but shorter than mesonotum. Lateral margins prominently and sharply toothed in the middle. Incisurial areas and posterior marginal area roughly wrinkled. The anterior lateral marginal areas covered with appressed, shining golden hairs. These pilose areas appear to be connected by a broad stripe across the face. Mesonotum with the lateral margins and the region before the cruciform elevation covered with long golden hairs. The region before the cruciform elevation encloses two small circular spots. The top of the elevation and its arms glabrous and shining.

Abdomen longer than the anterior half of the body, thickly pilose, second tergite the longest, sixth the shortest, eighth a little longer than the preceding one, narrowed posteriorly, and truncated behind, anal

tergite pointed and hardly visible from above. Tympanal orifice completely covered.

Tegmina pale brownish smoky. Venation partly dark fuscous and partly paler. Basal cell almost opaque and more than three times as long as wide. Basal membrane dark piceous. Cross-veins of apical cells 1, 2, 3, 4, 5, and 7 heavily infuscated. A series of six small fuscous spots just behind the ambient vein.

Face rather prominent. Rostrum nearly reaching the posterior margin of the first abdominal ventrite. Opercula reaching behind the fourth ventrite (the third one of Distant), concavely sinuate near the base, broadly pointed at the apex, and widely separated from each other. The space between the opercula is more than the width of the operculum at its broadest part. Legs faintly and broadly annulated.

Body length 48 mm. Widest part of pronotum 15 mm. Tegmina length 50 mm., width 16 mm.

Holotype male from Tumlong, Sikkim. A male from Langkat, Sumatra, and a female from Baran River, Borneo are much paler in color and in the female the face is almost glabrous with a central longitudinal fascia which is yellowish but they may belong to this species.

Terpnosia neocollina spec. nov.

Plate 1, Fig. 6

A small brown slender and elongate cicada with abdomen about one-half longer than the anterior half of the body and allied to *T. collina* Distant (Ann. Mag. Nat. Hist., (6), I, 1888, p. 371) by the absence of maculate spots on tegmina and by the shape and size of opercula. Body above nearly glabrous.

Head slightly declivous in front, shorter than the space between eyes, and including eyes about as wide as the base of mesonotum. Vertex reddish brown with a large central black spot on the ocellar region and three smaller black spots on each of the lateral areas. Tylus reddish brown with a spot at the apex ochraceous and the lateral transverse striations black. Antennæ dark fuscous with the basal segment reddish ochraceous and the base of the third segment paler. Eyes shining ochraceous, projecting, and with the posterior margin black. Ocelli shining ochraceous and about twice as far from the eyes as from each other.

Pronotum reddish brown with the lateral and posterior marginal areas and the central longitudinal lanceolate fascia reddish ochraceous and the following markings dark fuscous:—a longitudinal fascia on

each side of the central area, two oblique stripes on each of the incisurial areas, the outer incisure, two spots near the posterior angle (connected with the outer margin of the incisurial area), and the extreme posterior margin. Lateral margins deflected and posterior angles dilated. It is shorter than mesonotum (excluding cruciform elevation), narrowed anteriorly, and more than twice as wide as long.

Mesonotum reddish ochraceous with seven fasciæ from the anterior margin and two small spots in front of the cruciform elevation black. Of the seven fasciæ, the central one and the outmost pair reach the cruciform elevation. The pair next to the central one curved inward. The pair next to the outmost ones very small.

Abdomen (15 mm.) one-half longer than the anterior half of the body, gradually attenuated posteriorly, and suddenly constricted on the eighth segment. Tympanal flaps about one-third as long as the orifice, piceous black with a small basal spot ochraceous. Abdomen above reddish ochraceous with the first tergite black, two series of spots on tergites 3 to 6, and tergites 7 and 8, fuscous. Eighth tergite about as long as the preceding one. Anal segment prominent. Anal tergite indented in the middle on the posterior margin and extending as far as the genital plate.

Tegmina and wings hyaline. Tegmina a little more than three times as long as wide and wider than the wing. Basal cell elongate. Venation dark brown. Anal vein ochraceous. Venation of wings dark brown.

Body beneath with the anterior half thickly covered with appressed short pile. Face moderately prominent, globose, ochraceous with longitudinal lateral fasciæ black. The outer marginal part of these black fasciæ interrupted by a series of ochraceous stripes. A spot on lora, a large spot on clypeus, a spot beneath eyes (extending to face), black. Apex of rostrum, tarsi, outer extreme margin of opercula, streaks on anterior femora, lower part of tibiæ, reddish. Abdominal ventrites piceous but the second one dark castaneous.

Opercula not reaching the posterior margin of the second abdominal ventrite, narrow, short, oblique, widely separated from each other, and with the posterior angles rounded. Rostrum reaching the posterior coxæ. Seventh ventrite oblique, sinuate laterally, slightly sinuate behind, and shorter than the preceding one. Genital plate rounded behind, a little longer than the preceding one, dark ochraceous, with a central longitudinal fascia piceous.

Body length 24 mm. Widest part of pronotum 7 mm. Tegmina length 28 mm.

Holotype male from Mt. Angka, Siam (Asiatic Primate Expedition).

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. Pycna repanda Linnaeus
Fig. 2. Platypleura kæmpferi Fabricius
Fig. 3. Platypleura retracta Liu
Fig. 4. Platypleura hilpa Walker
Fig. 5. Pycna minor Liu
Fig. 6. Terpnosia neocollina Liu

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PLATE 2

PLATE 2

Fig. 7. Polyneura ducalis Westwood
Fig. 8. Graptopsaltria tienta Karsch
Fig. 9. Graptopsaltria colorata Stal, female
Fig. 10. Graptopsaltria colorata Stal, male
Fig. 11. Gæana maculata Drury
Fig. 12. Gæana maculata distanti Liu

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PLATE 3

PLATE 3

Fig. 13. Cryptotympana mandarina Distant
Fig. 14. Cryptotympana pustulata Fabricius
Fig. 15. Chremistica banksi Liu
Fig. 16. Oncotympana maculaticollis Motschulsky
Fig. 17. Pomponia fusca Olivier

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PLATE 4

PLATE **4**

Fig. 18. Lyristes flammata Distant
Fig. 19. Lyristes sinensis Distant
Fig. 20. Purana clavohyalina Liu
Fig. 21. Maua fukienensis Liu
Fig. 22. Tanna obliqua Liu
Fig. 23. Tanna japonensis Distant

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PLATE 5

PLATE 5

Fig. 24. Dundubia bifasciata Liu
Fig. 25. Dundubia mannifera Linnaeus
Fig. 26. Platylomia kingvosana Liu
Fig. 27. Meimuna neomongolica Liu
Fig. 28. Meimuna opalifera Walker

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PLATE 6

PLATE 6

Fig. 29. Huechys sanguinea Degeer
Fig. 30. Huechys hæmatica Distant
Fig. 31. Scieroptera splendidula Fabricius
Fig. 32. Mogannia cyanea Walker
Fig. 33. Mogannia cyanea yungshienensis Liu
Fig. 34. Mogannia hebes Walker
Fig. 35. Lycurgus subvitta Walker
Fig. 36. Terpnosia andersoni Distant
Fig. 37. Melampsalta neocruentata Liu


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PLATE 7

PLATE 7

Fig. 38. Melampsalta wulsini Liu
Fig. 39. Melampsalta radiator Uhler
Fig. 40. Melampsalta bifuscata Liu
Fig. 41. Lisu neokanagana Liu
Fig. 42. Terpnosia obscura Liu
Fig. 43. Terpnosia ichangensis Liu

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AT HARVARD COLLEGE

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MAMMAL AND BIRD COLLECTIONS OF THE ASIATIC PRIMATE EXPEDITION

Introduction, *by* Harold J. Coolidge, Jr.

Mammals, *by* G. M. Allen & H. J. Coolidge, Jr.

Birds from northern Siam, *by* James C. Greenway, Jr.

Birds from Mt. Kinabalu, N. Borneo, *by* James L. Peters.

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No. 3. — *Mammal and Bird Collections of the Asiatic Primate Expedition*

INTRODUCTION

By Harold J. Coolidge, Jr.

The Asiatic Primate Expedition was organized by H. Coolidge. Its personnel included Dr. Adolph H. Schultz, Associate Professor of Physical Anthropology at the Johns Hopkins School of Medicine and a research associate of the Carnegie Institution; Dr. C. R. Carpenter, lecturer in Psychology at Bard College and research associate of the Peabody Museum at Harvard; Sherwood L. Washburn, Harvard graduate student and Sheldon Travelling Fellow; John A. Griswold, Jr., research associate in the Museum of Comparative Zoölogy; H. G. Deignan, an ornithologist who collected with the expedition in Borneo; John T. Coolidge, Jr., and Andrew Wylie, volunteer assistants.

Financial contributions from thirty different sources have been acknowledged elsewhere. These included the Milton and Sheldon Funds at Harvard. Johns Hopkins Medical School and Bard College, Columbia University, have our gratitude for granting leaves of absence with salary to valued members of their faculties for participation in this cooperative undertaking.

It was in a large measure the interest of the beloved late Professor William Morton Wheeler, as well as Dr. Thomas Barbour, Dr. George B. Wislocki, Dr. Ernest A. Hooton, Mr. Donald Scott, Mr. Edward Mallinckrodt, Jr., Mrs. Amory A. Lawrence, and Mrs. James A. Sullivan that made the Expedition possible.

Generous cooperation was extended to us by the Royal Siamese Government, the British North Borneo Company and their officials, the government of French Indo-China, the military and civil officials of the Netherlands Indies Government in Sumatra, Mr. J. Holbrook Chapman, our chargé d'affaires in Bangkok, and other American foreign service officials in Bangkok, Singapore, Saigon, Batavia, Penang, and Medan. We owe special gratitude to the Presbyterian Mission in Chiengmai, particularly to Reverend William Harris, Principal of Prince Royal's College, Dr. Edwin C. Cort, Superintendent of the McCormick Hospital, Miss Bates of the Jesselton Hospital, Dr. V. A. Stookes of Sandakan, the Deli Maatschappij of Sumatra; and thanks to Mr. F. N. Chasen of the Raffles Museum, Mr. E. Banks of the Sarawak Museum, Dr. W. C. Osman Hill of Colombo, Dr. E. C. Dammerman of Buitenzorg, Dr. and Mrs. George Pinkley of the

American Museum, Baron Rodolphe M. de Schauensee of the Academy of Natural Sciences of Philadelphia, Dr. James Andrews of the Peabody Museum at Harvard, Mrs. and the late Mr. Martin Johnson, Mr. and Mrs. Harry Keith of Sandakan, Mr. Richard Evans and Mr. George Moffat of Jesselton, Dr. Lindsay Ride of the University of Hongkong, Mr. Peter W. Jansen, Mr. Herbert Cremer, Mr. P. G. Van Tienhoven, all of Amsterdam; Baron and Baroness Von Styrum of Medan, Mr. Monet B. Davis, our former Consul General in Singapore, Mr. Quincy Roberts, our former Consul in Saigon.

Contributions of equipment were gratefully received from the Remington Arms Company, the Burgess Battery Company, the Bell Telephone Laboratories, the Kohler Manufacturing Company, S. S. Pierce Company, the Borden Company, Dewey and Almy Chemical Company, J. H. Emerson of Cambridge, Dr. Robert K. Enders of Swarthmore, the Harvard Film Service, the Harvard Travellers Club and Dr. George C. Shattuck of the Harvard Medical School.

The Expedition operated in Siam,[1] French Indo-China, British North Borneo, and Sumatra from January to September, 1937. There were three main objectives for the field work. The first was to make collections of skins, skeletons, parasites and selected anatomical material, including embryos, of important primate types, especially the gibbon and the orang-utan. Five hundred specimens were collected. The primate collections were documented by detailed field measurements especially for comparative growth studies. Reports on various phases of the physical studies on primates are now in preparation by Schultz, Wislocki, Washburn, and Coolidge. Some preliminary reports have already been published.

The second objective was to make the first behavior study of wild gibbons in their undisturbed natural environment as well as a survey of the possibility of making a similar study of the orang-utan in Sumatra at some future time. Dr. C. R. Carpenter procured films and recordings as well as extensive notes, from which he is preparing a report on his gibbon behavior studies, and a brief report on the orang-utan in North Sumatra has already been published.

The third objective was to make general zoological collections for the Museum of Comparative Zoölogy from varying altitude zones in Northern Siam and British North Borneo. These totalled thirty-five hundred birds and mammals. A small collection, principally of large mammals, was also procured in French Indo-China. The pur-

[1]Now officially known as Thailand.

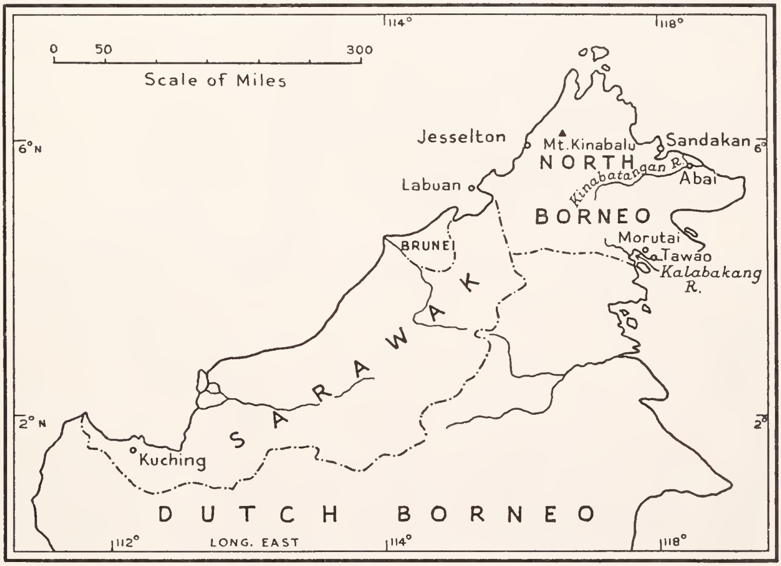
pose of this paper is to list with notes the more important birds and mammals procured in Siam, Indo-China, and North Borneo.

Mr. J. A. Griswold, Jr., was personally responsible for the making of a large part of the Kinabalu collection, and we are indebted to Mr. Wylie for a small collection of Indo-Chinese mammals.

The chief collecting in Siam was done in the Chiengmai region 350 miles north of Bangkok. The base camp for mountain collecting was at an altitude of 4300 ft. on Doi Intanon or Mt. Angka with additional collecting camps at about 5500, 6000 and 8075 ft. This third camp was at the summit of the highest mountain in Siam. There was another base camp at Chieng Dao at the foot of Mt. (Doi) Dao.

In Indo-China, Wylie did his collecting in the open forest of Southern Annam about 40 miles from Ban Me Thouet.

In North Borneo some collecting was done from Jesselton on the west coast, close to sea level. From this point Griswold made his

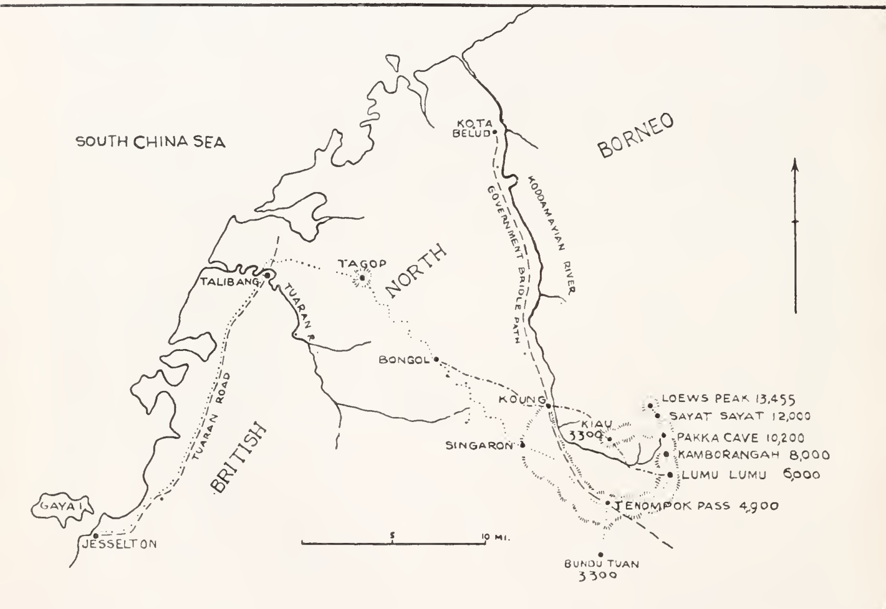


Sketch map of Northern Borneo to show collecting localities of the Asiatic Primate Expedition (1937).

ascent of Mount Kinabalu, the highest mountain in Malaysia. He collected for three months at varying altitudes, his principal base camp being at Lumu Lumu in the primary forest at 5500 ft. He also

had collecting camps at Bundutuan about 3300 ft., Pakka Cave about 10,000 ft., Sayat Sayat at 12,000 ft., and reached the summit of Lowe's Peak 13,455 ft.

On the east coast of North Borneo the primate study camp was at Abai near the mouth of the great Kinabatangan River, six hours by launch and 50 miles from Sandakan. H. G. Deignan collected lowland birds for us in the forest close to Sandakan, also at Merotai Besar, and at the mouth of the Kalabakang River on the east coast, not far from Tawao.



Detail map of Mount Kinabalu modified from F.M.S. Survey No. 149–1932, to show routes taken by J. A. Griswold and his collecting localities. Asiatic Primate Expedition, 1937.

.... Ingoing route
-.-.-.-.-.-.-.-.-.-. Outgoing route.

From late February until the rains start in May is the hot season in the Chiengmai section of North Siam. The country is as dry as a bone, the air hazy with smoke from forest fires, that leave behind them vast areas of charred leaves and stumps of tree trunks. At night

one can often see on the mountain slopes the twinkling of numerous forest fires which make a pink reflection on their own smoke. The temperature reaches 110° F. in April, and the nights seem almost airless, unless one is in the mountains where it cools off in the evening.

Chiengmai is a city of about thirty-five thousand inhabitants and lies at the northern terminus of the railroad 450 miles north of Bangkok and about 75 miles east of the Burma border. The city sprawls along the Me Ping River in the middle of a wide plain surrounded by hills. The plains are intensively cultivated for rice, with occasional patches of dry scrub forest.

The Chiengmai plain (1100 ft.) is bounded on the north and west by high mountains. The nearest and directly north is Doi Soutep, its granite summit rising 5000 ft. almost like an island in the plain. Northeast of Soutep looms Doi Dao (7150 ft.), a great limestone "massif" of many peaks whose summit is usually shrouded in mist and fog. This mountain, because of its geology, has numerous caves and jagged pinnacles. A sacred cave temple at its base is a place of pilgrimage for Siamese from many parts of the country. It was close to this temple that we had one of our camps. About fifty miles southwest of Soutep lies a range called Doi Intanon, which is locally known to the natives as Doi Angka. This is the highest mountain in Siam and rises to 8448 feet (official height) although it is not spectacular as seen from a distance, and it is less well known than the two other peaks closer to Chiengmai.

In general the vegetation of these mountain ranges was essentially similar. The first 1800 feet was covered with a dry deciduous forest of oak and bamboo, the ground underneath having plenty of loose stones and not very dense underbrush, except for bamboo thickets. From 1800 to 4500 feet, there was a zone of pine and oak forests with heavy undergrowth and occasional second growth tall grass and brush, which has filled up the agricultural clearings of mountain Karens. There was a considerable fringe of evergreen along the streams at the bottoms of the rivers. From 4500 to 7000 feet on Mt. Angka we found tall tropical evergreen forest with thick undergrowth, especially in the valley bottoms, while there was more open forest on the slopes. From 7000 feet to the summit the trees became stunted and gnarled. There was an increasing amount of coarse grass about three feet high where blowdowns had exposed the slope, but most of the upper ridge was thickly forested with dwarf trees heavily laden with epiphytic moss that also covered the ground. At the very summit was a depression in the mountain that reminded one of an old crater in which lies an open

grassy bog of several acres. From the account of my friend, Baron de Schauensee, the summit of Doi Dao was quite open and grass-covered, whereas there was no open vista in any direction from the summit of Mt. Angka.

On our arrival in Chiengmai on February 16 with two bird collectors, Lucas Bah and Peter Cheron from Bangkok, we were warmly welcomed by Rev. William Harris of the Presbyterian Mission, the principal of Prince Royal's College. He had engaged a native staff for us, and procured a splendid house overlooking the Me Ping River which was to serve as our base during three months in the Chiengmai area. He and Dr. E. C. Cort, director of the McCormick Hospital, helped us in every possible way.

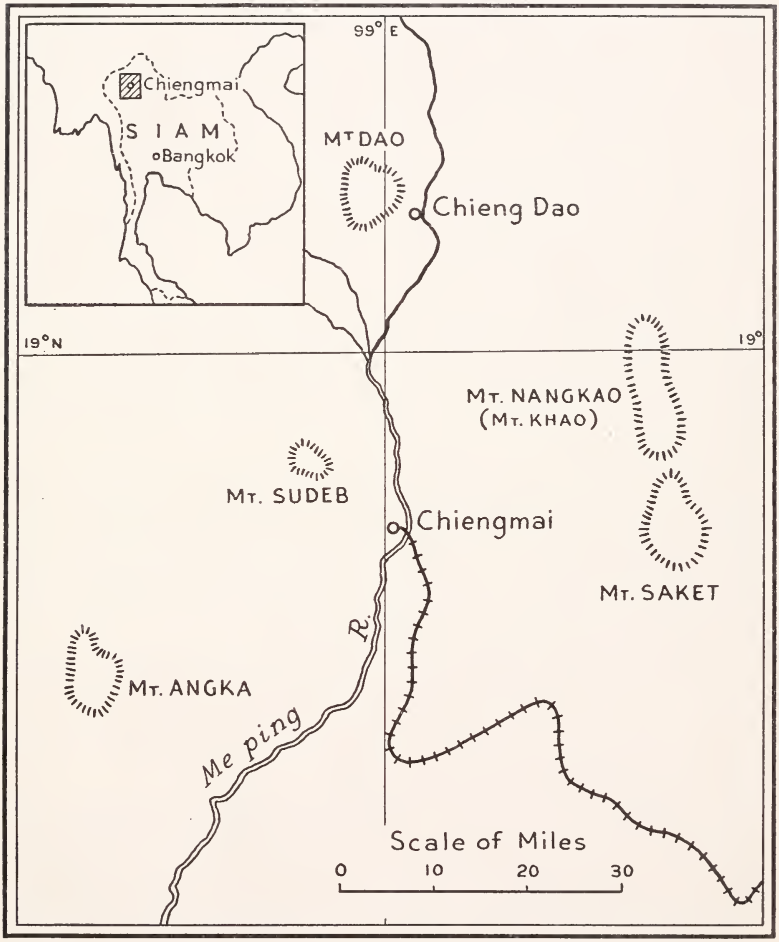
A few days were spent in scouting expeditions in various directions from Chiengmai, and as a result we decided to do our principal collecting on Doi Angka. To reach the base we had to go 70 kilometers, over a very rough road in a rented Siamese bus to a place called Mehoi. There porters were waiting by arrangement with the local "Amphur" who was very cooperative. We selected a place for our base camp near a former camp-site of the botanist Garrett at about 4300 feet on the edge of a small stream in a grove of tall trees, and not five minutes' climb from the lower edge of the high primary tropical forest belt. From Mehoi it was a two days' climb of 28 kilometers with ninety porters and a few pack ponies to the base camp. Much of the way the trail was not steep, and followed along the edge of a winding stream which was frequently used for bathing. This was a most welcome relief as the days were hot.

The porters that carried our equipment up the mountain to Camp 1 were Laotians, mostly farming coolies, from the Chiengmai plain. They carried 20 pounds on each of opposite ends of a bamboo pole which they balanced on their shoulder. They were paid one tical a day (about 45 cents U. S.) while loaded, and returned on their own time.

Four kilometers from our base camp was a Karen village. The Karens are quite primitive mountain people most of whom live over in Burma. They have some livestock and grow rice in terraced fields in the flatter mountain valleys between three and five thousand feet. We found Karens slow to take interest in zoological collecting, although one or two developed into good hunters and they were most useful as porters from our base camp to the higher camps, although generally lazy and slow minded.

Two hours from Camp 1 in another direction was a Meo village. The Meos are wilder than the Karens and very much more at home in

the forest. Many of them are good hunters and trappers and seem to go in very little for agriculture. Their huts are built of crude hand-



Sketch map of a section of Northern Siam to show collecting localities of the Asiatic Primate Expedition (1937).

hewn boards and set directly on the ground and not up on poles like the Karen houses. The result is the Meos live with any livestock, especially pigs, that they may happen to own, while the Karens live above them.

Camp 1, our base camp, was made up of several substantial shacks thatched with banana leaves. This was on Mt. Angka and was in operation from Feb. 25 to April 27. Being at 4300 feet, close to a small brook on the lower edge of the primary forest, it combined several advantages. Below us we had a fine view down a long valley. Nearby were considerable clearings occupied by farms of mountain Karens, there were wild banana plantations, wooded ridges, and almost every type of forest to be found on the mountain within an hour's climb up or down from camp. Tongues of the primary forest above us extended into the valley nearby. We were within reach of a Karen and a Meo village, and in altitude about halfway up the mountain. It usually took two to three days for supplies and messages to reach us from Chiengmai by special runner. At the time we were there the air was hazy with smoke from native brush and forest fires that rage entirely out of control day and night at this time of year. In fact only backfires and a fortunate change of wind saved us from losing our entire camp and kit from one of these fires. Our camp menagerie included leopard and bear cubs, gibbons, two kinds of macaques, parrots, turtles, and a python.

Above Camp 1 about two hours' climb in the heart of the primary forest, was Camp 2 (5500 ft.) which was occupied principally by Carpenter during preliminary behavior studies of gibbons from March 2 to March 20. With him at different times were J. Coolidge and S. Washburn. Near this camp we found a beautiful and rare forest magnolia (*Manglietia Garrettii*) in full bloom.

An hour and a half climb above Camp 2 was our over-night Camp 3 (6000 ft.) which consisted of a crude lean-to with a tarp thrown over it. This was also in the primary forest, but at a point where there was much less underbrush and the steepness of the mountain was very much greater than at the lower camps.

Camp 4 (8075 ft.) was on an island in the bog at the summit of the mountain. Griswold, Lucas and Peter collected there from March 24 to April 1st and were visited by H. Coolidge, Washburn, and Schultz. This camp was a unique one. The island was covered with soft moss and shaded by giant azalea (*Rhododendron Veitchianum*) and rhododendron trees (*Rhododendron arboreum*) with small white orchids clustered along their trunks. The bog, although open to the sky and filled with short grass, was surrounded by heavy forest. Small mammal traps set under almost any log sometimes brought a 50% yield. A number of birds and bats were caught by means of a bird net. Species of small mammals were collected, including the first record of *Chodsigoa*

smithii south of China, and the waterholes in the bog showed signs of sambur, barking deer, and an occasional seladang or large leopard. We saw no tiger tracks at the summit camp and few lower down.

On March 23, Carpenter established a new base camp at Chieng Dao (1300 ft.) close to the cave temple at the foot of Mt. Dao primarily for behavior studies on undisturbed wild gibbon families. This was located in a semi-deciduous forest at the base of wooded steep limestone crags which made it at times possible to observe and photograph gibbons from blinds on trails along steep slopes, and thereby get a far better view of them above or on their own forest level, than watching from the ground below. There were ten living gibbons of varying ages which he had as pets in this camp and which were later brought back for the Puerto Rico colony. Washburn spent 3 weeks with Carpenter observing families of wild gibbons and doing some collecting, and H. Coolidge was at the Chieng Dao camp for a week during which time he and Carpenter made films and the first successful recordings of wild gibbon calls on acetate discs, some of them with the help of a specially designed semi-portable 6-foot parabolic reflector. A number of reptiles and a few small mammals were also collected at Chieng Dao. Most of the members of the expedition packed up the Siam collections and left Chiengmai on April 30th for Bangkok, Angkor, Singapore, and North Borneo. Carpenter continued his work at Chieng Dao until the latter part of June. He was joined at the end of May by his wife and sister-in-law from America. At the conclusion of his behavior studies he collected specimens of langurs, macaques, and selected specimens of gibbons to check his field identification as to sex, age, etc. Some of these he embalmed for future dissection.

After leaving Siam we visited Angkor and arrived in Singapore at the time of the Coronation Celebration. May 16th saw us on board of the cargo boat Kadjang on our six day trip to North Borneo. The party consisted of Schultz, Washburn, Griswold, my wife (who had come from America and joined us at Angkor), and myself. We were later joined in N. Borneo by H. G. Deignan, an ornithologist now on the staff of the U. S. National Museum, and his native collector, Charlie. The Borneo collecting was carried on in three sections, one on the West coast operating from Jesselton. This was Griswold's collecting trip on Mount Kinabalu from June 7 to August 20. He has described his journey in "Up Kinabalu" in the Scientific Monthly, Vol. 48, May and June, 1939, pp. 401–414; 504–518.

The second section had its base camp at Abai near the mouth of the Kinabatangan River not far from Sandakan. Here Schultz and Wash-

burn built themselves a comfortable camp in the clearing formerly occupied by Martin Johnson's village. They collected from June to August with the help of an able native staff, procured through the kindness of Mr. Harry Keith, the Conservator of Forests. Their attention was primarily devoted to orangs, gibbons, and proboscis monkeys, for which a special permit had been granted by the Governor, as well as langurs and macaques. Here they collected a new color phase of *Trachypithecus pyrrhus cristatus* and the rare *Presbytis sabana*. The same procedure of measurements and preservation was used as in Siam. Abai is on the edge of mangroves and extensive stretches of nipa palms; along the river there were also very fine tall "mengaris" with long rattans and climbing bamboos. Langurs and proboscis monkeys were very plentiful here, and orangs and gibbons not infrequent. The climate was hot and damp, making it necessary to pickle skins in brine for preservation. A three-year-old pet orang named "Dish-face" added to the gaiety of the camp. This was a confiscated animal, purchased through the courtesy of the government.

The third collecting unit was made up of Deignan and his Dayak boy, Charlie, who concentrated on getting us lowland birds from the primary forest close to Sandakan, from Morutai Besar, the Kalabakang River on the east coast, and from Abai. Deignan did his field collecting from June 20 to August 12.

On the return journey to Singapore, an exchange for some small mammals included in this list was arranged through the courtesy of Mr. E. Banks, Curator of the Sarawak Museum at Kuching. After Carpenter had completed his work in Siam, he spent a month until the middle of August making a survey of Atjeh, North Sumatra. J. Coolidge left the expedition on account of illness on April 1. Andrew Wylie collected some mammals for us in southern Annam, Indo-China, from February 22 to May 1.

The last unit of the expedition had completed all field work by September 1, 1937.

MAMMALS

By Glover M. Allen and Harold J. Coolidge, Jr.

The following list of mammals collected by the Expedition includes the descriptions of new subspecies of *Myotis, Pteromys,* and two *Callosciurus,* and an account of an *erythristic* mutant of *Trachypithecus.* In separate short papers, a new race of tree-shrew, *Tana tana griswoldi,* has previously been described by Coolidge from the specimens collected in Borneo, as well as a new pygmy fruit bat, *Aethalops aequalis* by Allen. In listing the langurs, we have in most cases followed Pocock's revision (Proc. Zool. Soc. London, 1934). Further detailed study of the series procured by the Expedition should furnish additional evidence to support or contradict his conclusions.

The following reports have been frequently consulted in the preparation of this list:[1]

Banks, E.
1931. A popular account of the mammals of Borneo. Journ. Malayan Branch, Roy. Asiatic Soc., vol. 9, pt. 2, 139 pp.

Osgood, Wilfred H.
1932. Mammals of the Kelly-Roosevelts and Delacour Asiatic Expeditions. Field Mus. Nat. Hist., Zool. Ser., vol. 18, no. 10, pp. 193–339, pls. 9–11.

Pocock, R. I.
1935. The monkeys of the genera Pithecus (or Presbytis) and Pygathrix found to the east of the Bay of Bengal. Proc. Zool. Soc. London, for 1934, pp. 895–961, Jan. 14, 1935.

Raven, H. C.
1935. Wallace's Line and the distribution of Indo-Australian mammals. Bull. Amer. Mus. Nat. Hist., vol. 68, pp. 179–293.

Ptilocercus lowii lowii Gray

M.C.Z. No. 35380 1 M. Borneo, Sarawak, Kuching.

(Coolidge) Type locality the island of Labuan where it has recently been rediscovered. They are procurable from natives in and around Kuching according to Banks. This specimen came to us by exchange from him.

[1] This report was in proof when Chasen's 'Handlist of Malaysian Mammals' was received (Bull. Raffles Mus., No. 15, 1940).

TUPAIA BELANGERI CHINENSIS Anderson

M.C.Z. No. 35773, 35810–21, 35823–7, 35829–30, 35834–5, 35837–42 9 M., 14 F. Siam, Mt. Angka.

M.C.Z. No. 35822, 35831, 35836 2 M., 1 F. Siam, Mt. Nangkeo (Souket).

M.C.Z. No. 35828 1 F. Siam, Chieng Dao.

Specimens from varying altitudes between 1500 and 8000 feet.

(Coolidge) At first we were unable to get any until natives understood just what we wanted. We found Tupaias in localized populations in old clearings or wild banana plantations usually running along the ground or fallen logs. They were very quick and nervous. One came within six feet of me as I was seated on a log. We made a collection of embalmed specimens for anatomical study and also of embryos.

TUPAIA LONGIPES Thomas

M.C.Z. No. 36811–12 1 M., 1 F. Borneo, Sarawak.

TUPAIA MINOR MINOR Günther

M.C.Z. No. 36711 1 F. North Borneo, Kalabakang River.

M.C.Z. No. 36401–2 2 M. North Borneo, Mt. Kinabalu. Altitude 2000–3000 feet.

M.C.Z. No. 36809–10 2 F. Borneo, Sarawak, Kuching.

One of the smallest tree shrews. Common in Sarawak.

TUPAIA MONTANA MONTANA Thomas

M.C.Z. No. 36813 1 F. Borneo, Sarawak.

Highland form, mainly terrestrial. Found on Mts. Penrissen, Poi and Dulit about 3000 feet.

TUPAIA MONTANA BALUENSIS Lyon

M.C.Z. No. 36128–132, 36136–145, 36404–415, 36417–449 32 M., 28 F. North Borneo, Mt. Kinabalu. Altitude 3500–9790 feet.

Has a remarkable resemblance to *Funambulus everetti;* likewise found only on mountain tops. Largely terrestrial. It is both nocturnal and diurnal. Like all these high altitudinal animals this Tupaia has a heavy, thick fur, probably on account of cold and dampness.

TUPAIA PICTA Thomas

M.C.Z. No. 36806 1 M. Borneo, Sarawak.

Little known about habits. Found in Baram area of Sarawak.

TANA DORSALIS (Schlegel)

M.C.Z. No. 36807 1 F. Borneo, Sarawak.

Terrestrial; found in most parts of Sarawak but not noticeably above 3000 ft.

TANA TANA GRISWOLDI Coolidge

M.C.Z. No. 36416 1 M. North Borneo, Mt. Kinabalu. Alt. 3300 ft.

See A New Tree Shrew of the Genus Tana from Mt. Kinabalu, North Borneo, Proc. New Eng. Zoöl. Club, 17, pp. 45–47, May, 1938.

According to Chasen's recently published 'Hand list of Malaysian Mammals' (Bull. Raffles Mus., No. 15, p. 6, 1940) this is the same as *Tupaia tana chrysura.* A further comparison of the type with a *Tupaia tana chrysura* in the collection of the United States National Museum clearly shows that *chrysura* has a buffy tail and light feet which is clearly distinct from the dark tail and black feet of *griswoldi* hence could not belong to the same race.

TANA TANA UTARA Lyon

M.C.Z. No. 36748 1 F. Borneo, Sarawak, Kuching.
No. 36808 1 M.

One of the largest Tupaias and almost wholly terrestrial.

DENDROGALE MELANURA Thomas

M.C.Z. No. 36381–4, 36386–400 8 M., 11 F. North Borneo, Mt. Kinabalu.

(Griswold) Found from 4- to 11-thousand feet; active both by night and by day. One shot running up a tree. Would range lower if primary forest extended lower down.

HYLOMYS SUILLUS DORSALIS Thomas

M.C.Z. No. 36147–176 18 M., 12 F. British North Borneo, Mt. Kinabalu.

Numerous on Mt. Kinabalu in primary forest 4- to 11-thousand feet.

Hylomys siamensis Kloss

M.C.Z. No. 35452–3 2 F. Siam, Mt. Angka. Alt. 4300 ft. Type from Hin-op, Eastern Siam.

Trapped in metal box-trap under a log in a grove of wild bananas close to camp.

Echinosorex rafflesii (Horsfield)

M.C.Z. No. 36814 1 M. Borneo, Sarawak.

Talpa klossi Thomas

M.C.Z. No. 35381–4 4 F. Siam, Mt. Angka.

Dug out of garden by a native at 4000 ft.

Chodsigoa smithii parca G. M. Allen

M.C.Z. No. 35448–51 1 M., 3 F. Siam, Summit of Mt. Angka.

First record of *Chodsigoa smithii* south of China, and second record of any *Chodsigoa* (first was *lowei* at Chapa—Osgood).
All trapped at 8000-foot summit camp only.
In same traps with *Anourosorex.*

Crocidura baluensis Thomas

M.C.Z. No. 36541, 36546–7, 36549–50, 36554–57, 36560 4 M., 6 F. North Borneo, Mt. Kinabalu.

(Griswold) Found at 9, 10, 11 and 12 thousand feet, in mossy stunted low bushes, stunted trees, rocks, short grass—not forest.

Crocidura doriae Peters

M.C.Z. No. 36548, 36551–3, 36558–9, 36561–73, 36575 6 M., 13 F., 1 ? North Borneo, Mt. Kinabalu. Alt. 3080–11000 ft.

Crocidura foetida Peters

M.C.Z. No. 36574 1 F. North Borneo, Mt. Kinabalu. Alt. 5500 ft.

Native trap in forest at Lumu Lumu.

Crocidura vorax G. M. Allen

M.C.Z. No. 37427 1 alc., Siam, summit of Mt. Angka. Alt. 8075 ft.[1]

Suncus caeruleus (Kerr)

M.C.Z. No. 35809. Borneo, Labuan, Victoria.

The only specimen of this shrew was picked up dead in the road by H. G. Deignan and preserved as a skin. That none are secured at higher levels may indicate that it is introduced in the lowlands.

Anourosorex squamipes Milne-Edwards

M.C.Z. No. 35500–17 5 M., 11 F., 2 ? Siam, Mt. Angka.

Trapped only at the 8000-foot summit camp where they were very plentiful.

Crossogale phaeura (Thomas)

M.C.Z. No. 36542–45 4 F. North Borneo, Mt. Kinabalu. Alt. 3080–5500 ft.

Natives say they occur along the water.

Galeopterus variegatus borneanus Lyon

M.C.Z. No. 36801 1 M. Borneo, Sarawak.

Rousettus leschenaulti (Desmarest)

M.C.Z. No. 33081 1 F. Siam, Chieng Dao.
No. 33082 1 infant M. Siam, Chieng Dao.

Cynopterus brachyotis angulatus Miller

M.C.Z. No. 35475–8 3 M., 1 F. Siam, Mt. Angka. Alt. 4380 ft.

Cynopterus brachyotis brachyotis (Müller)

M.C.Z. No. 36630–667, 36680–684 20 M., 23 F. North Borneo, Mt. Kinabalu. Alt. 3080–5500 ft.
M.C.Z. No. 36752 1 M. Borneo, Sarawak, Kuching.

[1] All altitudes taken from expedition barometers.

(Griswold) Natives told me that they hang the thorny branches of the rattan palm on fruit trees, and often impale many fruit bats that come to devour the fruit.

Penthetor lucasi (Dobson)

M.C.Z. No. 36751 1 F. Borneo, Sarawak, Bidi Caves.
No. 36686–701 14 M., 2 F. North Borneo, Mt. Kinabalu. Altitude 4790 ft.

(Griswold) All these bats were caught at Labang Cave. This is nothing but a huge overhanging rock by a little stream, which is the beginning of the Kadamaian River. The natives sometimes made excursions there to secure bats to eat, as could be seen by the branches left at the mouth of the cave, which they used to knock the bats down. The native I went with made a sacrifice of rice and called to the spirits of the mountain before he would enter. Most of the bats would leave at the slightest noise.

Sphaerias blanfordi (Thomas)

M.C.Z. No. 35446–7 2 M. Siam, Mt. Angka.

On stream at 4000 ft. near base camp in bird net. The first record for Siam.

Aethalops aequalis G. M. Allen

M.C.Z. No. 36582–84, 36586 4 F. North Borneo, Mt. Kinabalu, Lumu Lumu.

This new species was taken in a bird net stretched in the forest, and is the first record of the genus for Borneo.

Pteropus vampyrus natunae Andersen

M.C.Z. No. 36818 1 F. Borneo, Sarawak, Kuching.

Rhinolophus acuminatus Peters

M.C.Z. No. 36095–36104, 36588–604 15 M., 12 F. North Borneo, Mt. Kinabalu. Altitude 3500–5500 ft.

Rhinolophus affinis macrurus Andersen

M.C.Z. No. 35494 1 F. Siam, Mt. Angka. Altitude 4300 ft.

Rhinolophus borneensis Peters

M.C.Z. No. 36081 1 F. North Borneo, Mt. Kinabalu. Altitude 3500 ft.

Rhinolophus luctus Temminck

M.C.Z. No. 36605–7 3 F. North Borneo, Mt. Kinabalu.

All caught at 4900 ft.

Hipposideros armiger armiger Hodgson

M.C.Z. No. 35483–93 5 M., 6 F. Siam, Mt. Angka. Altitude 4300 ft.

Myotis abbotti nugax subspecies nov.

Type. Adult male, skin and skull, no. 36076 Museum of Comparative Zoology, from Bundutuan, Mt. Kinabalu, North Borneo, 3500 feet altitude; collected July 25, 1937, by the Asiatic Primate Expedition, J. A. Griswold, Jr.

Description. A small-footed, dark-brown species, in general resembling *Myotis abbotti* of the Pagi Islands, off southwestern Sumatra, but with much shorter tibiae.

Dorsal coloration a uniform dark brown with a faint chestnut tint, about 'Prout's brown' of Ridgway, the forehead slightly paler, tinged with grayish and lacking the chestnut. On parting the fur, the brownish tint of the tips of the hairs is seen to grade imperceptibly into the slaty black of the extreme bases. On the under side of the body the fur is everywhere slaty black at the base, tipped on the throat with ashy, which passes into a soiled yellowish, nearest 'honey yellow', over the breast and abdomen. The membranes and rather narrow ears are dull brownish.

One or two individuals of the series are more reddish above, nearly 'cinnamon brown'. Immatures are duller above with less of the brown tipping to the fur, and the tips of the hairs on the under surface are whitish over the breast and abdomen as well as on the throat.

Measurements. The field measurements of the type are: total length, 86 mm.; tail, 36; ear, 11; tragus, 5. Additional measurements from the well-prepared skin are: forearm, 38.5 mm.; tibia, 14.4; hind foot, extended, with claws, 7.4; third metacarpal, 35.9; first phalanx of same, 13.3; second phalanx, 14.4.

The skull measures: greatest length, 14.5 mm.; basal length, 12.5; palatal length, 8.6; zygomatic width, 19.5; mastoid width, 7.5; width

across molars, 6.4; upper tooth row, 6.0; length of mandible, 11.2; length of lower tooth row, 7.2.

The skull is delicate and of the usual form in the small bats of the genus, with long rostrum and gently sloping profile. The first and second upper incisors are subequal, the inner with a minute posterior, the outer with a similar internal cusp. The first upper premolar is nearly triangular in section as seen from ventral view, with a minute cingulum and a blunt point which barely exceeds the cingulum of the canine. The second premolar is minute, slightly internal to the axis of the tooth row and hidden from the outside in the angle between the first and the third premolars, or it may be, as in the type, lost. The first and second upper molars have a well-marked inner cingulum, but the hypocone is barely traceable. In the lower jaw the small second premolar is minute and crowded inward from the tooth row, but the two others are not quite in contact.

The small-footed bats of this type, occurring in Borneo and other East Indian islands, have usually been included under the specific name *muricola,* but with a series of skins at hand, it becomes evident that the typical *Myotis muricola* of Nepal and the Himalayan foothills of India is quite a different animal, having long shiny ochraceous tips to the hairs of the upper side, besides differing in slightly smaller proportions, while the representative of the species in the East Indies is browner, without noticeably long burnished tips, and with a yellowish wash below instead of whitish. Lyon, in 1916 (Proc. U. S. Nat. Mus., 52: 441), described as *Myotis abbottii* this type of small bat from North Pagi Island, off southwestern Sumatra, with a forearm measurement of 38 mm. and tibia of 16.8 to 17.2 mm. The series from Borneo agrees essentially with his description except that the tibiae are markedly smaller. He supposed that this species was confined to the Pagi Islands, although it may be that specimens from the main island of Sumatra will not be found to differ very much. In the same paper he named as *Myotis niasensis* the slightly smaller form found on Nias Island, with a forearm of only 31.2–34.5 mm., and tibia 14–16.4 mm. With these dimensions agrees a small series in the Museum of Comparative Zoology from Java, but whether the two are in fact identical cannot yet be said. At all events, the representative of this group collected on Mt. Kinabalu more nearly agrees with *M. abbotti* and may for the present stand as a race of it. With the series are two very small young perhaps still unable to fly, taken on July 23 and 24, respectively. In addition to these, the series includes eight adults from

the type locality, taken July 24 and 25, and four others, July 15 and 17, from Tenompok, at 4900 feet on the mountain, M.C.Z. No. 36072–80, 36082–83, 36085–89, 36091.

Pipistrellus sp.?

M.C.Z. No. 36094 1 F. North Borneo, Mt. Kinabalu. Alt. 3080 ft.

Pipistrellus nitidus (Tomes)

M.C.Z. No. 36084, 36090, 36092–3 3 M., 1 F. North Borneo, Mt. Kinabalu.

All came from Tenompok, alt. 4900 ft.

Ia io Thomas

M.C.Z. No. 35479 1 M. Siam, Chieng Dao.

In Temple Cave. The first record outside of China.

Scotophilus gairdneri Kloss

M.C.Z. No. 35495 1 M. Siam, Mt. Angka. Alt. 4300 ft.

Miniopterus ? pusillus Dobson

M.C.Z. No. 35496–9 3 M., 1 F. Siam, Mt. Angka. Alt. 4300 ft.

Nycticebus bengalensis cinereus Milne-Edwards

M.C.Z. No. 38607–9, 35942 3 M. 1 F. Siam, Chieng Dao.
No. 35952 1 F. Siam, Mt. Angka. Alt. 4300 ft.

Nycticebus borneanus Lyon

M.C.Z. No. 36040–41 2 M. Borneo, Baram.
No. 36116 1 F. North Borneo, Jesselton.
1 F. North Borneo, Sandakan.

Nycticebus pygmaeus Bonhote

M.C.Z. No. 36035 Indo-China, southern Annam, Ban Me Thouet.

A single specimen of this very distinct species was secured by Andrew Wylie.

Tarsius tarsier (Erxleben)

M.C.Z. No. 35379 1 M. Borneo, Tabekang.

Presbytis chrysomelas Müller

M.C.Z. No. 36822, 36815 1 F., 1 juv. Borneo, Sarawak.

The female specimen was collected by Sliman at the foot of the Kalinkans Mts. This is clearly the black and red *cruciger* with crown, flanks, and outer surfaces of the legs red; the dorsal black band covering the whole of the back, white and reddish hairs on the abdomen and inner side of legs and arms. There is no gray on the throat and the white inner leg stripe is 13 mm. wide, an inch above the ankle. We agree with Pocock's opinion that this is an *erythristic* mutant of the blackish form *chrysomelas*. The juvenile is a young of the typical dark form.

Presbytis hosei Thomas

M.C.Z. No. 36816 1 F. Borneo, Sarawak.
M.C.Z. No. 37370–72 1 M., 1 F., 1 juv. Borneo, Mt. Kinabalu.

Our skins confirm the conclusion of Chasen and Kloss in 1931 as pointed out by Pocock that the adult female departs in head pattern from the normal coloration of the species which led to the description of *everettii*. Our juvenile female has the head pattern of the adult male which differs from the two adult females.

(Griswold) Although I never personally shot this species, I saw one small group at 4000′ and a single specimen at about 3000′. It only occurs in primeval forest and is rare on Kinabalu.

Presbytis rubicunda Müller

19 M., 21 F., 6 juv., 2 inf. North Borneo, Kinabatangan River, Abai.
1 M., 1 F. Mt. Kinabalu, North Borneo.

This material will be used in a later study of variation in coat characters of Bornean langurs. It is interesting to note here that Schlegel described the newly-born young as white without the cruciform pattern, turning ruddy at an early age. Our infants show two phases: one with white arms and legs and light ruddy hairs on the head, the entire back and the upper side of the tail with traces of black forming a narrow central line down the lower half of the tail. The second infant has dark brown hairs on the back, the arms and legs are turning

ruddy and there is a blackish brown area the whole length of the center of the tail. Fine blackish gray hairs are on the backs of fingers and toes of both infants.

(Griswold) Seems to be confined to the high forest. Banks records two from Mt. Murud at 6000′, at about which altitude I secured my specimen. It was in company with one other and was silently eating about twenty feet from the ground. It was the only specimen I saw alive, and doesn't seem to be common on Kinabalu.

Presbytis rubicunda ignitus Dollman

M.C.Z. No. 36820 1 M. Borneo, Sarawak, Baram.

No blackness about the hands and feet, differing in this from a considerable series of *Presbytis rubicunda.*

Presbytis sabana Thomas

M.C.Z. No. 35621, 35625 1 F., 1 inf. North Borneo, Abai.

The adult skin is similar to *hosei* in color of body, tail and limbs but the hair of the cheeks and temples is black and there is no white on the head, which is grayish black with a pale whorl patch on each side of the crown in front where the bases of hairs radiating from the whorls are exposed. The long black bristle hairs on the hair line of the forehead are 38 mm. long as compared with 20 mm. on two adult *hosei* specimens. *Sabana* has a larger white forehead area between the eyes and the hair line than is found in *hosei.* The black skin below the eyes does not extend to as great a height on either side of the nasal ridge in *sabana* as in *hosei.* The white hair of the abdomen has less brilliance than in *hosei* and has scattering gray hairs among it. While the black hairs on the back of the hands are similar to *hosei,* on the legs the black is confined to below the ankle in *sabana* and extends half the way up the leg in *hosei.* The white hairs on the inner side of the upper leg extend lower down in *hosei* than in *sabana.* The following measurements indicate the larger size of the *sabana* as compared with an adult male and female *hosei,* although a two pound weight difference is within the individual variation range of the closely allied *rubicunda.*

Sabana Female		*Hosei Male*	*Hosei Female*
Weight:	14½ lbs.	—	12½ lbs.
Total Length:	1275	1174	1055
Tail Length:	755	709	600
H. F. Length:	177	172	150

The infant *sabana*, of which I can find no recorded description, is largely white with a gray stripe about 17 mm. wide extending from behind the shoulder to the tip of the tail, while the underside of the upper half of the tail has a narrow white stripe, the lower half is all gray. There are scattered long black hairs on the cheek and a fringe of long black hairs along the forehead hairline. There are two small whorls on either side of the midline just above the forehead. The head is covered with soft short white hairs with a sprinkling of gray. There is a small central crest on top of the head. There are gray hairs mingled with white on the hands, feet, and lower arms. The small callosities are a greenish color. The skin resembles in many ways the young of *hosei* described by Chasen and Kloss in 1931. The infant weighed 1¼ lbs. and measured T. L. 575; T. 340; H. F. 93; E. 18; trunk height 131.

Historical

Hitherto our recorded knowledge of this monkey rare in collections is limited to Thomas' completely original description of two males obtained by A. Everett at Paitan in N. Borneo (Thomas, Ann. & Mag. Nat. Hist. (6) XII, p. 230, Pl. VII, 1893) and Chasen and Kloss' description of the first female specimen which they procured at Betotan (Chasen and Kloss, Bull. Raffles Mus., Singapore, No. 6, p. 7, 1931). Ours agrees with their description except for the fact that our female has gray patches on either side of the crest and vertex, with mainly black hairs on the crest, resembling more Thomas' description of the male in this respect and confirming Pocock's opinion (p. 923, Proc. Zool. Soc. London, 1934). There is also a specimen in the Field Museum from North Borneo. Washburn reports that natives said these langurs were more numerous higher up the Kinabatangan River than Abai.

Trachypithecus pyrrhus germani Milne-Edwards

M.C.Z. No. 37746–48 2 M., 1 juv.F. Indo-China, S. Annam, Ban Me Thouet.

We agree with Pocock and Osgood that there is no distinct evidence for separating *margarita* from *germani*. The resemblance between *germani* and our series of Bornean *cristatus* is most striking.

Trachypithecus phayrei crepusculus Elliott

7 M., 13 F., 4 juv., 4 inf. Siam, Chiengmai, Mt. Angka and Chieng Dao.

We follow Pocock although this langur agrees very well with Kloss' description of *argenteus*. Our specimens are uniformly pale silver gray

with dark hands and feet and light gray on the abdomen. They probably resemble the paler skins of the series secured by A. S. Vernay east of Um Pang on the Mewong River, Siam, referred to by Pocock (Fauna of British India, Vol. I, p. 135, March, 1939). The pale eyelids and pale patch on the mouth, the uniform colored tail and dark hands and feet, in spite of the absence of a "cap", would suggest that we are dealing with a race of the general *obscurus* type resembling in some respects *phayrei*, which may well be even from many of the characters set forth by Pocock but another race of *obscurus*. The young are golden.

Trachypithecus pyrrhus cristatus Raffles

15 M., 26 F., 10 juv., 7 inf. North Borneo, Kinabatangan River, Abai.
6 M., 8 F., 5 juv. North Borneo, near Jesselton.

This series varies in the silveriness of the tips of the hairs and will be used in later studies of variation both in skeleton and in coat characters of Bornean langurs. The most striking thing about it is the occurrence of an erythristic mutant obtained by Washburn and Schultz.

These orange-cinnamon phase langurs show no significant skull or skeletal differences from the gray *cristatus* with which they were associated. They do show a very marked skin and coat color difference in the adults and a less marked but still distinguishable difference in the infant. An adult female of the light phase has the same hair pattern on head, body, arms, and legs as the dark form. In the light phase the bare skin of face, hands, and feet is light with a freckling of dark pigment spots which is particularly heavy in the area around the nose and mouth.

In the dark form there is a uniform dark pigment in these areas of hairless skin. In the light phase the hairs of the head, shoulders, arms, legs, are orange-cinnamon under certain lights in the same areas. The hairs are dark mouse gray in the dark form. At other angles tips of the hairs appear spangled with silver in both forms. This silver gray is prevalent on the back of the crest, the arms, legs, and tail of both forms. The underside of the tail is silver gray in both forms.

In comparing infants of approximately equal weight and size, we find the hair on the light phase infant is considerably longer and not so fine as that of the dark phase. There is a better developed crest and longer hairs around the ears in the light phase. The hairs on the back, belly, arms, legs, and upper tail give a spangled effect because of the large number of silver gray hairs which are so characteristic of the adult. The dark phase infant has none of these hairs. He may be a

slightly younger animal. In the light phase infant, the hair on the head, back, arms, legs, and tail is an almost uniform light orange-cinnamon which grades into a silver white on the sides, stomach, and underside of the upper quarter of the tail.

The dark phase infant has short wavy hairs on his back and the ground color of the back of his head, his back, tail, arms, and legs is a uniform light orange-cinnamon without the silver-gray hair tips of the light phase. The dark phase infant has black brow lashes, and a sprinkling of black hairs on the front of his head. He has a concentration of black and gray hairs on the backs of his hands, and the backs of his feet. There is more gray in the feet than in the hands. His tail is not silvered on the under side and is more uniformly brownish and short haired than that of the light phase. An even younger infant of the adult dark phase shows exactly similar markings.

By way of summary, the light phase infant has a longer and better developed coat with many silver tipped hairs by contrast with the short, soft, wavy haired dark phase infant. The light infant shows no trace of dark pigment which is evident in the hairs on the forehead, hands, and feet of the dark phase infant as well as in the skin of face, hands, and feet.

The field measurements of all age groups show no significant differences between the light phase and the dark phase. Neither does a comparison of their skeletons.

Seven out of fifteen adult males collected at Abai were light phase and only three out of twenty-six adult females. This indicates that about 46% of the males collected in this area are light as against 12% of the females. The collectors were not instructed to concentrate on any kind. In a collection of six adult males and eight adult females from near Jesselton on the northwest coast of Borneo not a single specimen showed the light phase. Counting all age groups, the series from Abai totalled 58 of which 14 or about 24% were of the light phase.

Mutants are not uncommon in Bornean langurs. There is, for example, *cruciger* which Pocock, Chasen and Kloss agree is a red mutant of *chrysomelas*. Pocock points out reddish and whitish mutants of *Presbytis melalophus*. He also adopts the name *Trachypithecus pyrrhus* for the typical Javan form whose dominant color phase is nearly jet-black, although the name *pyrrhus* was given by Horsfield to a couple of red mutants both female and now in the British Museum. He uses this name instead of *maurus* or *auratus* under which it has often been cited. The type of *C. auratus* comes from an unknown locality.

On the shafts of the hairs in the light phase is an occasional sprin-

kling of dark pigment that is only noticeable on close examination and gives the effect of fine grain dark pepper having been spilled on the skin. Under the microscope these turn out to be bits of dark pigment of the color found in the dark form.

In comparing the coat colors of juvenile forms we find the same color differences as in the adults.

In comparing the coat colors of two male infants of about equal age and size, each weighing one pound, we find a completely light skin color on the face, hands and feet of the orange phase and a grayish brown pigmented skin on the face, hands and feet of the dark phase.

Mr. Sherwood L. Washburn deserves special thanks, not only for the able way that he collected and prepared this material, but also for his field investigation which determined that three specimens in our series came from families or groups containing both gray and orange *cristatus* which strengthens the conclusion that we are here dealing with a mutation of the gray form of *cristatus*.

Pygathrix nigripes Milne-Edwards

M.C.Z. No. 36224, 36259, 37745 1 F., 1 M., 1 inf. M. Indo-China, S. Annam, Ban Me Thouet.

This striking looking langur is rare in collections. The question of its relationship to *nemaeus* has been discussed by Thomas (1928).

The infant male shows the same color pattern as that which is found in the adult female. He only lacks the reddish brown collar on the underside which is found in the male although he shows traces of it on the side. The grayish white hairs are not annulated on the abdomen of the infant or the adult female, as they are in the adult male. Examination of an adult male and female in the Field Museum shows more annulation on the female than the male. This must be an individual character of no sexual significance.

Nasalis larvatus (Wurmb)

9 M., 13 F., 6 juv., 7 infs. North Borneo, Kinabatangan Riv., Abai.

These langurs were plentiful in the heavy stand of nipa palms in the mangrove swamps close to our camp at Abai on the Kinabatangan River. One male that was collected weighed as much as 52 pounds. These Proboscis Monkeys were found in troops up to twenty in number. Martin Johnson had his camp in the same locality two years before and made fine pictures of captive *Nasalis* which were released in

his film entitled "Borneo" shortly after the tragic accident in which he lost his life.

Macaca assamensis coolidgei (Osgood)

M.C.Z. No. 35920, 37710 1 M. 1 juv. Siam, Mt. Angka. Alt. 6000 ft.
No. 37704–5 2 M., 2 F. Siam, Chieng Dao.
No. 37707–8.

The skins from specimens obtained at Chieng Dao are generally cinnamon brown on body, shoulders, back, rump, arms, legs, and tail. The under parts and inner sides of arms, and legs are soiled whitish. The brownish hairs are generally mouse color basally and apically cinnamon brown, sometimes with black tips. The face color is generally dark. The hairs grow directly back from the forehead. These differ from typical *assamensis* as represented by skins from Sikkim in the Field Museum collection because they lack the reddish area around the shoulders. They have no oval of black hair about a central whorl on top of the head. They have less heavy coats, and shorter tails than the skins from Sikkim. They resemble more closely *coolidgei* although they are paler and browner than this Indo-China form described by Osgood, and have a less heavy coat. They may well represent an extreme variation of *coolidgei* away from typical *assamensis* although they are geographically nearer to the range of the latter than are Osgood's specimens. The adult male and juvenile female from 6000 feet on Mount Angka have very much paler arms and legs and more gray and white on the face, head and neck than those from Chieng Dao. The hair on the back of the head and shoulders is long as might be expected in a mountain form. The male has a central whorl 22 mm. back of his forehead hairline and the juvenile a whorl 12 mm. back. The juvenile mountain specimen has a hairless tail and the male a scantily haired tail. The skulls are essentially similar to those of the *assamensis* specimens. The adult male's measurements are: L. 602, T. 216, H. F. 167, E. 41, Wt. 17½ lbs. The collectors' measurements on a *coolidgei* recorded by Osgood from Chapa, Tonkin, give a tail length of 215; hind foot 167. These two Siam mountain specimens probably represent extremes in a pale variation of *Macaca assamensis coolidgei* although more material may justify referring them to a different race.

Macaca irus Cuvier

21 M., 24 F., 35 juvs., 4 inf. North Borneo, Kinabatangan River. and Jesselton.

This macaque seems to be equally at home in the mangroves of the coastal rivers and 4000′ up on the mountains. The largest male we collected weighed 15 lbs. and the largest female 9½ lbs.

Macaca irus aurea Geoffroy

1 sub-adult M. S. E. Siam, Arranya.

Our specimen agrees with the main characters of *aureus* (Pocock—Fauna of British India, Vol. 1, p. 79, March 1939). "The hairs of the temple and under part of the cheek sweep backwards from the face, partly concealing the ear, then downwards and forwards towards the corner of the mouth and finally upwards, the general arrangement being circular and resulting in a definite whorl and a small crest low down on each side of the muzzle." In addition, our skin has a heavy sprinkling of black hairs and brown hairs with black tips on the crown of the head. This forms a distinct whorl in the median line 50 mm. back of the forehead hairline. Behind this whorl the hair slopes from either side of the top of the head meeting to form a small crest which extends for 35 mm. back from the central whorl. The general hue of the upper side is olivaceous brown due to the ochreous annulations of the hairs. The limbs are gray, lighter on the underside. The tail is dark gray with a light underside. The hairs on the abdomen are white.

As Pocock points out this is a race variable in color and size. He gives its distribution as Lower Burma, Tenasserim, Mergui Archipelago, and S.W. Siam. Our specimen indicates an extension of the range to S.E. Siam.

Macaca mulatta (Zimmerman)

M.C.Z. No. 37706 1 M. Siam, Chieng Dao.

This rhesus specimen is unusually bright colored. It has a pale face with shoulders, back, tail and upper leg a light ochraceous buff on the apical ends of mouse gray hairs. The hairs on the arms are cinnamon brown but the hairs on the sides and front of legs are also ochraceous buff.

Macaca nemestrina (Linnaeus)

M.C.Z. 35598, 35687, 35631, 35635, 35589, 35646, 35670 2 M., 4 F., 2 juvs. North Borneo, Kinabatangan River, Abai.

M.C.Z. 37419, 374229 2 juvs. North Borneo, Mt. Kinabalu.

The largest male weighed 22 lbs. and the largest female 14 lbs.

Macaca (Lyssodes) speciosa Cuvier

M.C.Z. No. 37022 1 juv. Indo-China, S. Annam, Ban Me Thouet.

Hylobates lar (Linnaeus) ? subsp.

North Siam, Chiengmai, Mt. Angka and Chieng Dao.

Our considerable series includes complete skeletons and shows some of the characters attributed by Kloss to typical *Hylobates lar lar* and some to *lar entelloides*. One of us has in preparation a detailed study of the coat characters in this series which when completed should definitely indicate the race we are dealing with and the extent of possible color variation in a localized area. Both black and light phases are represented. Dr. A. Schultz has in preparation a study of growth and variation in gibbons largely based on this material, much of which he measured in the field and personally helped to prepare. Reproductive tracts and embryos have been turned over to Dr. George Wislocki of the Harvard Medical School.

Hylobates moloch[1] funereus (I. Geoffroy)

4 M., 3 F., 4 juvs. North Borneo, Kinabatangan Riv., Abai.
1 F. North Borneo, Mt. Kinabalu.

Our specimens agree with those assigned by Kloss to this race of Bornean gibbon and come from close to the same locality where he and Mr. F. N. Chasen obtained 3 males and 3 females in 1927.

(Griswold) The single specimen that was collected on Kinabalu was shot around 5000′. The cheery gibbon call could be heard almost every morning around the altitudes of 4000′ to 5000′. These apes were scarce, as neither I nor my native collectors ever saw but one group during my 1½ month stay at Lumu Lumu.

Hylobates mülleri Martin

M.C.Z. No. 35881 1 M. S.E. Borneo, 13th mile.

Pongo pygmaeus (Hoppius)

M.C.Z. No. 37358–65 2 M., 3 F., 2 juvs. North Borneo, Kinabatangan River, Abai.

The Orang appeared to be quite plentiful along the lower Kinaba-

[1] Vide Cabrera, P. Z. S., 1930, p. 257.

tangan River. It was reported locally that the natives of the region are very apt to shoot them in spite of the protective laws.

(Griswold) Labuan saw an Orang utan at 6000 ft., just below camp. It is undoubtedly very rare at this altitude, as I never saw one.

Helarctos malayanus (Raffles)

M.C.Z. No. 35890 1 juv. Siam, Mt. Angka. Alt. 4300 ft.

This bear cub named "Cinder" was brought in by natives and made a most entertaining pet, constantly sparring with two young macaques. He strangled himself with his own chain one night.

Cuon javanicus infuscus Pocock

M.C.Z. No. 35919 1 F. Siam, Mt. Nangkeo (Souket).
No. 35929 1 M. Siam, Mt. Angka. Alt. 4300 ft.

The female was shot by Lucas, one of our collectors, while chasing a sambur. The male killed by a native, weighed 25 pounds. The Karens used the urine and gall bladder for medicine.

Mustela nudipes Desmarest

M.C.Z. No. 36577 ? North Borneo, Mt. Kinabalu.
No. 36719 1 M. Borneo, Kalabakang R.
No. 36747 1 M. Borneo, Sarawak, Kuching.

One skin was bought from a native who said he killed it in his chicken house. 3000 ft., Kiau.

Charronia flavigula (Boddaert)

M.C.Z. No. 37008, 35457 2 F. Siam, Chieng Dao.
35895 1 F. Siam, Mt. Angka. Alt. 4300 ft.

Charronia flavigula henricii (Westerman)

M.C.Z. No. 36817 1 F. Borneo, Sarawak.

Nesictis everetti (Thomas)

M.C.Z. No. 36109–115, 36117–121 3 M., 9 F. North Borneo, Mt. Kinabalu.

(Griswold) This ferret-badger is a purely primeval-forest dweller and occurs from 3500 ft. to 9800 ft., but is not very common. I once

saw one at Paka Cave in the early morning; it did not move very fast but moved like a weasel in and out of the shrubbery; lost for one minute only to appear for a minute running along to some log and then into some thicket. They are quite tenacious of life.

Arctonyx collaris F. Cuvier

M.C.Z. No. 35894, 35932 2 F. Siam, Mt. Angka. Alt. 4000–4300 ft.

Micraonyx cinerus (Illiger)

M.C.Z. No. 36766 1 F. Borneo, Sarawak.
No. 36627 1 F. North Borneo, Talibang near Tuaran.
No. 36726 1 F. North Borneo, Kalabakang R.

Viverra zibetha Linnaeus

M.C.Z. No. 35880 1 F. Siam, Doi Souket. Altitude 1560 feet.
No. 35916 1 M. Siam, Mt. Angka. Altitude 4000 feet.

Shot at night with headlight; was feeding on the vulture bait near camp.

Viverra tangalunga Gray

M.C.Z. No. 36976 1 M. North Borneo, Abai.

Viverricula malaccensis (Gmelin)

M.C.Z. No. 35888–9 1 M., 1 F. Siam, Mt. Angka. Altitude 4300 feet.

Prionodon gracilis (Desmarest)

M.C.Z. No. 36576 1 F. North Borneo, Mt. Kinabalu.

Caught at night in Dusun trap at 6000 ft. Banks records it on Kinabalu from about 3000 ft.

Arctogalidia leucotis (Horsfield)

M.C.Z. No. 35899, 35915, 35927 2 M., 1 F. Siam, Mt. Angka. Altitude 4300 feet.
M.C.Z. No. 36819 1 M. Borneo, Sarawak, Kuching.

Arctogalidia stigmatica (Temminck)

M.C.Z. No. 36770 1 F. N. Borneo, Mt. Kinabalu.

Weight $4\frac{1}{2}$ lbs. Caught in Dusun trap.

Paradoxurus hermaphroditus laotum Gyldenstolpe

M.C.Z. No. 35873, 35891 Siam, Mt. Angka. Altitude 4300 feet.

Paradoxurus hermaphroditus sabanus Thomas

M.C.Z. No. 36724 1 F. North Borneo, Sandakan.

Paguma larvata leucocephala Gray

M.C.Z. No. 36767, 36769 2 M. North Borneo, Mt. Kinabalu. Altitude 3300 feet.

Caught in Dusun traps.

Arctictis pajeli Schwarz

M.C.Z. No. 36974 1 M. North Borneo, Abai.

Herpestes brachyurus rajah Thomas

M.C.Z. No. 36725 1 M. North Borneo, Kalabakang R.
No. 36805 1 F. Borneo, Sarawak.

Felis bengalensis bengalensis Kerr

M.C.Z. No. 35784 1 juv. Siam, vicinity of Chiengmai. Altitude 1100 feet.
No. 35892 Siam, Mt. Angka. Altitude 4300 feet.

Brought in by Meo of nearby native village.

Felis bengalensis undata Desmarest

M.C.Z. No. 36768 1 M. North Borneo, Mt. Kinabalu. Altitude 4700 feet.
No. 36821 1 M. Borneo, Sarawak, Kuching.

Trapped in Dusun trap.

Felis nebulosa Griffith

M.C.Z. No. 35930 1 M. Siam, Chiengmai.

Brought in freshly killed by natives to our house in Chiengmai from vicinity of Chieng Dao, killed near house where it had been raiding chickens.

Felis pardus fusca F. A. A. Meyer

M.C.Z. No. 35867–8 2 juv. Siam, Mt. Angka. Altitude 4300 feet.

Taken by natives from a leopard's den and kept in camp as pets.

Felis pardus delacouri Pocock

M.C.Z. No. 36629 Indo-China, S. Annam, Ban Me Thouet.

A skin and skull collected by Andrew Wylie are referred to this race of which the specimen is nearly topotypical.

Manis pentadactyla dalmani Sundevall

M.C.Z. No. 35947, 35957 Siam, Mt. Angka. Altitude 4300 feet.

Tip of tail with scales in two rows.

Paramanis javanica (Desmarest)

M.C.Z. No. 35720 North Borneo, Mt. Kinabalu. Altitude 4300 feet.
No. 35926 Siam, Chiengmai.

Tips of tails white.

Lepus siamensis Bonhote

M.C.Z. No. 35864–6, 35870, 35872 3 F., 2 juv. Siam, Mt. Angka. Altitude 4300 feet.

The type locality is Chiengmai. One specimen was caught barehanded by a native, while it was dazzled at night by a flashlight. The weight of one female was 3 pounds.

Pteromys everetti Thomas

M.C.Z. No. 36378 1 M. North Borneo, Mt. Kinabalu. Altitude 5500 feet.

(Griswold) Heard almost every night at Lumu Lumu, and undoubtedly common, but terribly difficult to shoot and harder still to find in the thick underbrush.

Petaurista lylei Bonhote

M.C.Z. No. 35459–60, 35466 1 M., 2 F. Siam, Mt. Angka. Altitude 1500–4300 feet.

M.C.Z. No. 35466 1 M. Siam, Chieng Dao.

Petaurista annamensis Thomas

M.C.Z. No. 36628 M. Indo-China, southern Annam, Ban Me Thouet.

Petaurista punctatus banksi Chasen

M.C.Z. No. 36579–36580 1 M., 1 F. North Borneo, Mt. Kinabalu. Altitude 5500 feet. Topotypes.

(Griswold) The type of *Petaurista p. banksi* Chasen was female; collected at Lumu Lumu on 12 Nov. 1933, by a botanist who killed it with a stone. Both my specimens were gotten at Lumu Lumu, one at night (see account in my paper), the other in the early morning. Neither was more than 75 ft. from my camp. I also saw one other glide across the clearing of an evening. These two flying squirrels are the second and third specimens ever to be collected. The type has no skull or measurements.

Pteromys phayrei laotum (Thomas)

M.C.Z. 35779–83 3 M., 1 F., 1 ? Siam, Chiengmai. Altitude 1000 ft.

Five specimens from Chiengmai agree with Thomas's description of this race from northern Siam and the Laos Mountains. The dorsal coloring varies from 'orange cinnamon' to 'pinkish cinnamon', with which the hairs of the back are broadly tipped. At the sides these brown tips pale to gray. The bases of the hairs are dark, nearly 'slate gray', becoming blackish at the edge of the membrane.

In contrast with these from the lower country is a series of four skins from the montane forest at some four thousand feet or more on Mt. Angka, collected a few days later (in the last of February). This lot is uniformly different in color, lacking the bright brownish tint, and has noticeably smaller ear bullae. It evidently represents a more saturate highland race which may be called

Pteromys phayrei anchises subsp. nov.

Type. Adult male, skin and skull 35776, Museum of Comparative Zoology, from Mt. Angka, northern Siam, 4300 feet altitude; collected February 27, 1937, by the Asiatic Primate Expedition.

Description. General tone of the dorsal surface, including forehead, crown, nape and back about pale 'wood brown', lacking altogether the more or less ruddy tint of the Chiengmai series referred to *P.p. laotum.* The hair pattern as seen when the fur is parted, shows the basal two-thirds of the hairs a 'deep neutral gray', then a short ring of blackish brown, succeeded by a short tip of pale buff, near 'pinkish buff' of Ridgway. On the flanks, the blackish subterminal ring becomes broader and the pale tips paler and shorter, until at the margin of the lateral membrane the blackish predominates and the pale tips give a mere hoariness. A narrow black ring surrounds the eye, from which there extends to and below the ear a pale grayish area, with gray-based hairs, which is continued up behind the ear as a narrow stripe, forming a half-collar of lighter. The sides of the face below the eye are pure white to the roots of the hairs, as are also the chin, chest, inner side of the fore legs and a narrow median area extending back nearly to the root of the tail and lower side of the femora. The rest of the ventral side of thorax and hind legs is white with gray bases to the hairs, and there may be a faint suffusion of pale 'straw yellow', possibly the result of staining. The toes and the inner margins of the feet are white; but the metapodial area is dusky. The extreme base of the tail is pale at the sides and more extensively so below, becoming 'warm buff' at the edges. Elsewhere the tail is blackish, with dull white showing through, and shades to a black tip and edges terminally; ventrally the central portion is soiled whitish. Ears nearly naked on the inner surfaces and sparsely clad with short scattered black hairs exteriorly.

Measurements. The type measured in the flesh: head and body, 178 mm.; tail, 143; hind foot with claws, 37; ear 22. The skull measurements are practically as in the race *laotum*, except for the size of the audital bullae, which in this mountain race are uniformly about one fifth smaller in antero-posterior extent. The skull of the type gives the following: greatest length, 42.5 mm.; basal length, 35.4; palatal length, 21.3; zygomatic width, 26.8; mastoid width, 19.5; width across molars, 11.0; upper cheek teeth, 9.5; lower cheek teeth, 8.7; antero-posterior length of bulla from front to junction with mastoid, 8.0 (in the series of *laotum* this measurement is 9.5).

The series of these flying squirrels (M.C.Z. No. 35775–8, 3 M., 1 F.) from the upper slopes of Mt. Angka is so different from the Chiengmai series in its lack of ruddy tints that it was remarked at once; the two series were taken at the same season of year (end of February) so that the difference can hardly be one of fading to any extent, while the obviously greater size of the audital bullae in the lowland animal makes

it apparent that the two are distinct, the new race perhaps confined to the upper forested levels of the mountains.

Reithrosciurus macrotis Gray

M.C.Z. 35660 North Borneo, Kalabakang R.

A specimen of this remarkable squirrel secured by H. G. Deignan was the only one obtained by the expedition.

Ratufa gigantea stigmosa Thomas

M.C.Z. No. 35874–6 1 M., 2 F. Siam, Mt. Angka. Altitude 4000–4600 feet.
No. 35877 1 F. Siam, Chieng Dao.
No. 35878–9 1 M., 1 F. Siam, Mt. Nangkeo (Souket).

Shot one lying out full length on a high branch with legs hanging down on either side. Weight of one male was 4 pounds (Griswold).

Ratufa affinis sandakanensis Bonhote

M.C.Z. No. 36581, 36587 2 F. North Borneo, Mt. Kinabalu. Altitude 4000 feet.

(Griswold) Two females of this giant squirrel were shot weighing 3 and 3½ lbs. respectively. It occurs in old forest around 4000 ft. but certainly not much above that altitude and is uncommon on Kinabalu. It is quite slow, for a squirrel, and makes a clucking noise that can be heard at some distance.

Ratufa ephippium (Müller)

M.C.Z. No. 36760–1 1 M., 1 F. Borneo, Sarawak.

Callosciurus baluensis baluensis (Bonhote)

M.C.Z. No. 36122–27 3 M., 3 F. North Borneo, Mt. Kinabalu.

(Griswold) All shot at Lumu Lumu, 5500 ft. Quite active in the trees, where it frequents the lower branches. Quite common and seems to be confined to mountain at an altitude of 6000 ft. or thereabouts.

Though regarded by Robinson and Kloss, in their list of Oriental squirrels (1918) as a race of *Callosciurus prevosti*, it seems quite possible that this may as well be treated as a distinct species, characteristic of the highland fauna of Borneo above three thousand feet. In a recent

paper Banks (1933) has indicated that it is present in the montane forests of Mt. Kinabalu, Mt. Murud, and Mt. Dulit, that is the upper parts of the north-central mountain chain, but is absent from the isolated peaks of Mt. Penrissen and Mt. Poi, farther to the southwest. Some years since, the Museum of Comparative Zoölogy received from E. Mjöberg a series of four squirrels taken on Mt. Tibang in the central part of the island, on the border of Dutch Borneo, a region included by Banks in the area above three thousand feet where the highland fauna occurs. These squirrels were tentatively identified as *C. baluensis*, but now with topotypes of that species for comparison, it is clear that the Mt. Tibang series represents a well-defined race which we propose to call

CALLOSCIURUS BALUENSIS MEDIALIS subsp. nov.

Type. Adult female, skin and skull 22265, Museum of Comparative Zoölogy, from Mt. Tibang, (central) Dutch Borneo; collected in 1925 by E. Mjöberg.

Diagnosis. Like *C. baluensis* but at once distinguished by having a prominent black line down the middle of the ventral side, feet without areas of clear orange rufous but uniformly ticked like the back and limbs, tail not clear black but its long hairs in part tipped with rufous and at their bases ringed with ochraceous.

Description. Upper lips, chin and upper part of rostrum nearly to the eyes clear 'orange rufous', merging at the forehead into the finely ticked black and ochraceous of the entire dorsal surface of body, limbs and feet. On close inspection the pattern here is seen to be the result of a mixture of longer stouter hairs of shining black with a narrow subterminal ring of 'orange rufous', and abundant shorter, slightly crinkly hairs having gray bases and minute tips of 'light orange ochraceous', that is, yellower and less red than the bands on the longer hairs. The general appearance of the dorsal surfaces is thus a minutely ticked black and rufous. Inside of ears very slightly more rufous, their backs a little clearer black than the crown. Eye-ring 'orange rufous', cheeks mixed black and 'light orange ochraceous'. At the sides a narrow whitish to pale buffy stripe, 4–5 mm. wide extends from axilla to groin; immediately ventral to this and practically coextensive with it is a broader stripe, about 17 mm. wide of intense black, while in the mid-ventral line another narrower stripe of black, some 4–5 mm. wide, runs from the lower throat to the abdomen, not quite equalling the lateral black lines in posterior extension. The remainder of the under surface including chin, throat, and under side of arms back between the

black stripes to the base of the tail and on the inside of the hind legs to the ankles and the inner border of the heel, is clear 'orange rufous'.

The tail appears shining black both above and below with scattered minute 'orange rufous' tips to some of the hairs, but on parting these long hairs it is seen that their long black ends partly conceal two or three short rings of lighter 'orange ochraceous'.

Measurements. No flesh measurements accompany any of the specimens but the hind foot of the type measures 58 mm., with claws.

The skull of the type measures: greatest length, 52.6 mm.; basal length, 47.3; palatal length, 27.0; zygomatic width, 33.3; width across molars, 12.3; upper cheek teeth, 9.1; lower cheek teeth, 9.3.

This race of the central highlands of Borneo differs strikingly from typical *baluensis* of Mt. Kinabalu, in the strong development of the narrow black line in the center of the red belly, whereas in the latter this line is absent or represented by a few scattered black hairs in the center of the abdomen. In all those of the typical race the feet are bright ochraceous, whereas in the Mt. Tibang series they are not brighter than the back while even more striking is the completely black tail of the former and the slightly variegated tail of the latter. This is doubtless a montane form confined to the highland forest of central Borneo.

Callosciurus erythraeus zimmeensis (Robinson & Wroughton)

M.C.Z. No. 35354–8 8 M., 6 F. Siam, Mt. Angka. Alt. 4300 ft.
No. 35361–9.

This squirrel, although described as a race of *C. atrodorsalis*, should doubtless go in the *erythraeus* series, as Osgood has suggested. Of a series of fourteen from slightly over 4300 feet on Mt. Angka, five show a well-marked dorsal band of deep black from shoulders to base of tail; in five others the band is narrower and confined to the lower half of the back; while in the remaining four the band is hardly evident except as a slightly darkened median area where black predominates in the generally ticked pattern of the back. On the lower surface this mixed coloring extends to the chin and throat, and usually forms a median line dividing the red of the belly all the way from the chest to the base of the tail.

Callosciurus ferrugineus primus subsp. nov.

Type. Adult female, skin and skull 35352, Museum of Comparative Zoölogy, from Mae Wan River, near Mt. Souket, northern Siam,

1500 feet altitude; collected February 20, 1937, by the Asiatic Primate Expedition, J. Augustus Griswold, Jr.

Description. Upper side of head from just back of the nose pad, the cheeks, the forehead back to a line joining the anterior bases of the ears, and the entire dorsal side of the body from about the base of the neck on to the proximal inch or two of the tail, are the usual finely ticked mixture of black and 'warm buff', continuing, but slightly grayer on the upper sides of the legs and feet to the tips of the digits which are very slightly blacker. With a lens it is seen that the pelage consists of (a) shorter, finer hairs slaty at the base with 'warm buff' to 'ochraceous buff' subterminal rings and a minute black tip, and (b) longer, coarser hairs with two or three narrow rings of the same colors alternating with broader black rings and having a conspicuous black tip. The hairs of the crown of the head and nape have the paler rings much intensified in color with 'orange rufous', giving this region a decidedly ruddy tone, which gradually pales into the duller ticking of the shoulders. The ears on both surfaces are conspicuously 'bright orange rufous' with a few all-black hairs on the rims. The color of the back extends to about the basal third of the tail above, beyond which for a short distance the black rings of the hairs produce four or five distinct transverse bands, while the terminal half of the tail is a conspicuous uniform rich 'ferruginous'. Ventrally, the middle third of the tail shows the alternating black and 'pale ochraceous' bands in the medial area, with the lateral fringe and the tip ferruginous.

The entire ventral side of the body from chin to anus, and the legs to the wrists and ankles is a nearly uniform chestnut red, nearest bright 'tawny' of Ridgway, the chin itself duller, about 'ochraceous orange'. Both specimens, the type and a second skin from the same locality, agree closely except that the latter is slightly more suffused with orange rufous on the nape and shoulders. Mammae four, inguinal, as characteristic of the genus.

Skull. The skull agrees with others of the *ferrugineus* series of squirrels in its larger size and proportionally broader interorbital space as compared with that of the *erythraeus* group. The small spicular upper premolar is situated full in the tooth row at the middle point of the large premolar.

Measurements. No flesh measurements of the type were taken but the paratype, a male, M.C.Z. No. 35353, from Doi Souket, measured: total length, 433 mm.; tail, 216; hind foot, 52.5; ear, 15; the hind foot of the type measures 53.7 mm. in the skin. The skull of the type measures: greatest length, 54.8 mm.; basal length, 47.5; palatal

length, 27.0; zygomatic width, 33.2; mastoid width, 23.8; width across molars, 13.0; interorbital width, 19.5; upper tooth row, 10.5; lower tooth row, 10.8; jaw from condyle to upper base of incisor, 32.5.

These two squirrels from Mt. Souket are remarkably interesting in that they apparently represent not only the most northern form of the *ferrugineus* series, but also the nearest approach to what must have been the primitive color pattern of the group in which the upper surface still shows the minutely ticked, 'pepper-and-salt' mixture of black and ochraceus, while erythrism, which in the southern forms extends to practically the entire pelage, is here but just beginning to appear dorsally in the ruddy tint of the crown and nape, the rufous ears and the chestnut of the terminal half of the tail. The under side of the body and limbs is completely 'red' (bright tawny), even to the chin and throat, which in most of the *erythraeus* series are instead of the same mixture as the back, and this often continued as a median ventral stripe to the base of the tail. The description of *C. erythraeus pranis* reads much like that of the new form, but this race of southern Siam, of which specimens have been examined is obviously a small member of the *erythraeus* series, and shows a much less amount of red in the tail and a mixed ochraceous-and-dark throat. In southern and eastern Siam and French Indo-China, the species is almost completely erythristic, with in occasional specimens, a slight hint of an originally speckled area on cheeks or arms.

Callosciurus vittatus dulitensis (Bonhote)

M.C.Z. No. 36799, 36754 Borneo, Sarawak, Baram.
No. 36704 1 F. North Borneo, Morutai Besar.
No. 36705, 36706 2 F. North Borneo, Abai.
No. 36254–58, 36328–77 29 M., 26 F. North Borneo, Mt. Kinabalu. Altitude 2000–5500 ft.

(Griswold) All those from Mt. Kinabalu were taken around Kiau at an altitude of about 3000 ft. It frequents the second growth and is abundant.

Callosciurus prevostii banksi (Chasen)

M.C.Z. No. 36800 1 F. Borneo, Sarawak.

Callosciurus prevostii caroli (Bonhote)

M.C.Z. No. 36781 1 F. Borneo, Sarawak.

Callosciurus prevostii griseicauda (Bonhote)

M.C.Z. No. 36780 1 F. Borneo, Sarawak.

Callosciurus prevostii kuchingensis (Bonhote)

M.C.Z. No. 36779 1 M. Borneo, Sarawak.

Callosciurus prevostii pluto (Gray)

M.C.Z. No. 36716 1 M. North Borneo, Abai.

Tomeutes hippurus grayi (Bonhote)

M.C.Z. No. 36758 1 M. Borneo, Sarawak, Baram.

Tomeutes hippurus hippurellus (Lyon)

M.C.Z. No. 36759 1 M. Borneo, Sarawak, Kuching.

Tomeutes hippurus pryeri (Thomas)

M.C.Z. No. 36717–8 1 M., 1 F. North Borneo, Kalabakang R.

Tomeutes jentinki (Thomas)

M.C.Z. No. 36291–311 7 M., 13 F. North Borneo, Mt. Kinabalu.

(Griswold) This small squirrel is found on the mountain from 3300 ft. to 7000 ft. It was common around Lumu Lumu. Although very active it was silent, always in the trees rather than on the ground.

Tomeutes lowii (Thomas)

M.C.Z. No. 36403 1 M. North Borneo, Mt. Kinabalu. Altitude 3500 feet.
M.C.Z. No. 36715 1 M. North Borneo, Kalabakang R.

(Griswold) Undoubtedly a lowland species.

Tomeutes tenuis parvus (Miller)

M.C.Z. No. 36749 Borneo, Sarawak, Mt. Dulit.
No. 36756 1 M. Borneo, Sarawak, Mt. Penrissen.

Dremomys rufigenis ornatus (Thomas)

M.C.Z. No. 35334–47, 35832–3 8 M., 8 F. Siam, Mt. Angka. Altitude 4300 feet.

No. 35348–51 2 M., 2 F. Siam, Mt. Nangkeo.

Menetes berdmorei consularis Thomas

M.C.Z. No. 35370–5 2 M., 4 F. Siam, Mt. Angka. Altitude 4300 feet.

No. 35376–7 1 M., 1 F. Siam, Mt. Nangkeo (Souket).

Rhinosciurus everetti (Thomas)

M.C.Z. No. 36146, 36225–252, 36475 17 M., 13 F. North Borneo, Mt. Kinabalu.

(Griswold) One of the commonest animals of the upper slope of Kinabalu along with *Rattus alticola* and *Tupaia baluensis* and *Rattus baluensis*. It ranges from 3500 ft. to 11,000 ft. At 11,000 ft. it is rare. Common from 3500 to 6000 ft. Found in the deep jungle or primary forest. I believe all were caught in Dusun traps.

Rhinosciurus laticaudatus (Müller & Schlegel)

M.C.Z. No. 36753 1 M. Borneo, Sarawak, Kuching.

Tamiops macclellandi kongensis (Thomas)

M.C.Z. No. 35845–8, 35853–4 3 M., 3 F. Siam, Mt. Angka. Altitude 1450 to 4300 feet.

No. 35849, 35851–2 2 M., 1 F. Siam, Chiengmai.

No. 35850 1 F. Siam, Mae Wan R., Mt. Souket.

Nannosciurus whiteheadi Thomas

M.C.Z. No. 36311–19 4 M., 5 F. North Borneo, Mt. Kinabalu.

(Griswold) Ranges from 3000 ft. to around 6000 ft. Not very common. It frequents low trees and also runs around on the ground and in the underbrush. Although really very tame it will scurry away from you. I watched one for over two minutes that sat not more than 4 ft. from me.

Nannosciurus exilis sordidus Chasen & Kloss

M.C.Z. No. 36712–4 1 M., 2 F. North Borneo, Sandakan, Abai, Kalabakang R.

Nannosciurus exilis (Müller & Schlegel)

M.C.Z. No. 36755–6 1 M., 1 F. Borneo, Sarawak, Kuching.

Leggada booduga Gray

M.C.Z. No. 35855 1 F. Siam, Chiengmai.

Leggada pahari gairdneri Kloss

M.C.Z. No. 35774, 35785–6, 35798–808, 35843–4, 35905–6, 35912 7 M., 7 F., 3 juv., 2 ? Siam, Mt. Angka. Altitude 4300 feet.

Rattus alticola alticola (Thomas)

M.C.Z. No. 36450–476, 36506–513, 36516–519, 36522, 36528–530 28 M., 15 F. North Borneo, Mt. Kinabalu.

(Griswold) A spiny rat of the primary forest, which is now only found on the upper slopes of Kinabalu from 4000 to 8000 feet. This rat was the most common species and occurs as far up as 11,000 ft., but is comparatively rare at that altitude. All caught in Dusun traps or snares.

Rattus alticola ochraceiventer (Thomas)

M.C.Z. No. 36177–9 2 M., 1 F. North Borneo, Mt. Kinabalu. Altitude 3300 ft.

Rattus berdmorei (Blyth)

M.C.Z. No. 35385 1 F. Siam, Mt. Angka. Altitude 4300 feet.

Rattus concolor (Blyth)

M.C.Z. No. 35859–60, 35863 1 M., 2 F. Siam, Chiengmai.

Rattus concolor ephippium (Jentink)

M.C.Z. No. 36196–219, 36525–27, 36532 13 M., 15 F. North Borneo, Mt. Kinabalu.

(Griswold) Common around 3000 ft.; never found in virgin jungle. All specimens bought. Caught in native traps.

Rattus fulvescens (Gray)

M.C.Z. No. 35518–20, 35544 2 M., 1 F., 1 ? Siam, summit of Mt. Angka. Altitude 8070 feet.

M.C.Z. No. 35787, 35792–3, 35795–6, 35861 5 M., 1 F. Siam, Mt. Angka. Altitude 4300 feet.

M.C.Z. No. 35788 1 ? Siam, Mt. Nangkeo (Souket).

Rattus indosinicus Osgood

M.C.Z. No. 35521–31, 35546–51 8 M., 8 F., 1 juv. Siam, top of Mt. Angka. Altitude 8070 feet.

M.C.Z. No. 35857 1 M. Siam, Mt. Angka. Altitude 4300 feet.

Rattus infraluteus (Thomas)

M.C.Z. No. 36105–8 3 M., 1 F. North Borneo, Mt. Kinabalu. Topotypes.

(Griswold) This large black rat is comparatively rare. I caught specimens from 5000 ft. to 7000 ft. It seems more plentiful at 7000 ft. One specimen weighed 1¼ lbs. All trapped.

Rattus muelleri borneanus (Miller)

M.C.Z. No. 36765, 36802 2 F. Borneo, Sarawak.

Rattus rapit (Bonhote)

M.C.Z. No. 36195, 36479–80, 36483–89 7 M., 3 F. North Borneo, Mt. Kinabalu. Altitude 3080 to 11000 feet. Topotypes.

Rattus rattus baluensis (Thomas)

M.C.Z. No. 36491–505 6 M., 9 F. North Borneo, Mt. Kinabalu.

(Griswold) Only at higher altitudes; very plentiful, from 9 to 11,000 ft. This rat is quite tame, running over your face or eating your food if you sleep out on the ground.

Rattus rattus diardi (Jentink)

M.C.Z. No. 36764, 36804 2 M. Borneo, Sarawak.

Type from Java.

Rattus rattus sladeni (Anderson)

M.C.Z. No. 35858 1 M. Siam, Mt. Angka. Altitude 4300 feet.

Rattus sabanus (Thomas)

M.C.Z. No. 36290, 36490 1 M., 1 F. North Borneo, Mt. Kinabalu. Altitude 3300–7000 feet.

Rattus surifer surifer (Miller)

M.C.Z. No. 35545 1 F. Siam, Doi Nangkeo (Souket). Altitude 4300 feet.

Rattus surifer bandahara (Robinson)

M.C.Z. No. 36482 1 F. North Borneo, Mt. Kinabalu.
No. 36763 1 M. Borneo, Sarawak.

Single specimen caught at Lumu Lumu the third day. Altitude 5500 feet.

Rattus whiteheadi (Thomas)

M.C.Z. No. 36180–194, 36220–223 8 M., 11 F. North Borneo, Mt. Kinabalu.

Seems to occur from 3000 to 7000 feet.

Chiromyscus chiropus (Thomas)

M.C.Z. No. 35790 1 M. Siam, Mt. Nangkeo.
No. 35794 1 F. Siam, Mt. Angka. Altitude 4300 feet.

Chiropodomys legatus Thomas

M.C.Z. No. 36535–39 2 M., 3 F. North Borneo, Mt. Kinabalu. Altitude 3300–4900 ft.

All bought from Dusuns.

Chiropodomys pusillus Thomas

M.C.Z. No. 36540 1 M. North Borneo, Mt. Kinabalu.

Bought from Dusun at Kiau, 3080 feet.

Eothenomys melanogaster confinii Hinton

M.C.Z. No. 35532–4, 35537–43 7 M., 2 F., 1 juv. Siam, summit of Mt. Angka. Altitude 8070 feet.

Cannomys badius (Hodgson)

M.C.Z. No. 35769–72 3 M., 1 F. Siam, Mt. Angka. Altitude 4300 feet.

Rhizomys pruinosus senex Thomas

M.C.Z. No. 35935–36, 36036–37, 3 juv., 1 ? Indo-China, southern Annam, Ban Me Thouet.

Three of these specimens, collected by Andrew Wylie, are young, but all are tentatively referred to the subspecies *senex*.

Trichys lipura (Günther)

M.C.Z. No. 36776 1 F. Borneo, Kuching.

Sus cristatus jubatus Miller

M.C.Z. No. 37006. Skull, Indo-China, southern Annam, Ban Me Thouet.
No. 35925. 1 F. Siam, Mt. Angka. Altitude 4300 feet.

Type from Trong, Lower Siam.

This sow was wounded by our native hunter Kawa and charged him. We found three embryos in her and she weighed more than 250 lbs.

Tragulus kanchil affinis Gray

M.C.Z. No. 37004–05. Indo-China, southern Annam, Ban Me Thouet.

Two skins and skeletons were secured by Andrew Wylie and are presumably this race, typical in Cambodja.

Muntiacus muntjak curvostylis (Gray)

M.C.Z. No. 37002 1 M. Siam, Chieng Dao.
No. 35917–18, 35928 3 M. Siam, Mt. Angka. Altitude 4300 feet.

Two of these were shot night hunting. They weighed 53, 58, and 62 lbs.

Cervus porcinus annamiticus Heude

M.C.Z. No. 37003 F. Indo-China, southern Annam, Ban Me Thouet.

A skin and skeleton of a female were brought back by Andrew Wylie.

Rusa unicolor (?) equinus (Cuvier)

M.C.Z. No. 35923–4, 35926, 35964 1 M., 1 F., 1 juv. Siam, Mt. Angka. Altitude 4300 feet.

No. 36679 F. Indo-China, southern Annam, Ban Me Thouet.

These were shot night hunting close to camp, the female by Champee by moonlight. The adult male weighed 238 pounds.

Bibos gaurus readi Lydekker

M.C.Z. No. 36669–70, 36673, 36677–78, 36778. Indo-China, southern Annam, Ban Me Thouet.

A skeleton and several more or less incomplete skulls secured by Andrew Wylie.

Bibos banteng (Raffles) subsp?

M.C.Z. No. 36672, 36674, 36676, 36777. Indo-China, southern Annam, Ban Me Thouet.

Two skulls, two frontlets, and a skin and skeleton were secured by Andrew Wylie. The proper name for this animal is still somewhat in doubt. Père Heude in 1901 (Mém. concern. Hist. Nat. de l'Emp. Chin., vol. 5, pt. 1, pp. 3–9) bestowed a number of names upon the bantings of Indo-China, based on slight variations in skull characters. These antedate the names given by Lydekker, namely *Bos sondaicus butleri* (1905), type from Perak, and *Bos sondaicus porteri* (1909), type from Siam. Which of these names may be valid for the animal from Annam will require further study with adequate material. Osgood suggests that the first of Heude's names, *Gauribos laosiensis*, may be the valid one.

Novibos Sauveli (Urbain)

As supplementing the work of the Expedition, mention may here be included of a specimen of the recently discovered forest ox or Kouprey, secured for the Museum through the interest of Mr. J. C. Greenway, Jr., of M. Delacour's "VIIe Expédition en Indo-Chine". It was taken at Samrong, Cambodia, and consists of the tanned hide and much of the skeleton. An illustrated account of the history and characters of the species was published by Coolidge (Mem. Mus. Comp. Zool., vol. 54, pp. 419–531, 11 pls., 1940), who has made it the type of the new genus, *Novibos*.

BIRDS FROM NORTHERN SIAM

By James C. Greenway, Jr.

One thousand and sixty birds comprising eighty-seven forms were collected by J. A. Griswold, Jr. and native collectors at Chieng Mai, on Mt. Angka and Mt. Nangkao. This report is not a complete list of the collection, but the interesting species are noted. This region of northern Siam is peculiar in that mountains rise abruptly from the rice fields of the plains, constituting from the point of view of the mountain avifauna, a region of islands, the lowlands being as unsuited to most mountain birds as an ocean. Genera which are peculiar to these mountains are, as might be expected, distributed through the Himalayan region, east to western China and the mountains of Tonkin and Laos, and to the southward through Burma, Tenasserim and Malaya in suitable places.

These mountains are, geographically speaking, intermediate between the mountains of Tenasserim and those of Laos. Though a conclusive comparison of series of birds of Karrenni, Mt. Muleyit and other topotypical localities in Burma with those of northern Siam has not been possible, it appears that the subspecies are not characteristically intermediate but vary in an apparently fortuitous manner. This is illustrated well by the distribution of the forms of *Mesia argentauris* (*vide* Mayr and Greenway, Proc. New Engl. Zool. Club, **17**, 1938, pp. 1–7) and *Garrulax erythrocephalus* (*vide* Deignan, Proc. Biol. Soc. Wash., **51**, 1938, pp. 87–92). This type of variation which one associates with color varieties, by which is meant the vast majority of insular subspecies or races in birds, does not appear to be intimately connected with any process of evolution as at present understood, and though there can be no doubt that the characters are transmitted through the genotype, the processes of their transmission are not known. The only known prerequisite for this insular and discontinuous type of variation is isolation.

I thank very much H. G. Deignan and the officials of the U. S. National Museum, R. M. de Schauensee and the officials of the Academy of Natural Sciences of Philadelphia, and, most especially E. Mayr and the officials of the American Museum of Natural History of New York for the loan of material and their helpful assistance.

Corvus macrorhynchus macrorhynchus Wagler

1 ♀ Mt. Angka (4300 ft.) 26 Feb.

This specimen is intermediate between *macrorhynchus* and *andamanensis*. It is identical with the former in color but somewhat smaller. The wing measures 308 mm. and the culmen 59 mm. as against 315, 319, 338 (wings) and 57, 65, 63 (culmen) for Javanese specimens.

The name *macrorhynchus* is of course older than *levaillanti* (*vide* Baker, Faun. Brit. Ind., Birds, **8**, p. 593).

I regard *mengtszensis* La Touche as a synonym.

Crypsirina temia (Daudin)

1 ♂ Chieng Mai, 17 Feb.

C. t. longipennis Neumann (Bull. B.O.C. **55**, 1935, p. 135) has been synonymized by Chasen (Bull. Raffles Mus., Singapore, **11**, 1935, p. 309, footnote) who says that the measurements of Siamese and Javanese birds overlap (112–120 mm. for Siamese birds, against 113–119 mm. for Javanese birds).

Measurements of series at hand are as follows: Burma (females) 125,118 mm; Siam (male) 116.5; Cochin China 114.5; Java (male) 116, 112.5, (female) 110.5, 112.

Paradoxornis gularis transfluvialis (Hartert)

4 ♂ 2 ♀ Mt. Angka (4300 ft.) 1–15 March

Three races may be recognized solely on the basis of size. I can find no other constant differences.

Measurements:

	P.g. fokiensis (David)		
Males		Females	
Wing	Tail	Wing	Tail
91–100	80–91	90–91	76–83
	P.g. gularis (Gray)		
Sex ?			
90–92	75–79		
	P.g. transfluvialis (Hartert)		
86–92	77–82	82–87	75–79

Material examined: *P.g. fokiensis* 7♂ 5♀ from Kuatun and the Yenping Mts., Fokien, in the Museum of Comparative Zoölogy.

P.g. gularis 7 ? "Sikkim" in the Rothschild Collection and the Museum of Comparative Zoölogy.

P.g. transfluvialis 4 ♂ 2 ♀ from Guilang, Cachar, in the Rothschild Collection; 6 ♂ 4 ♀ from Mt. Angka and Chieng Mai, northern Siam.

Garrulax erythrocephalus melanostigma Blyth

7 ♂ 5 ♀ Mt. Angka (7600 to 8100 ft.) 23, 24, 26, 27, 28, 30 March
6 ♂ 1 ♀ Mt. Angka (4300 & 5700 ft.) 5, 15, 17, 18, 19 March

Deignan records these specimens as *G. e. melanostigma* > *schistaceus*, *schistaceus* being the race of Doi Chieng Dao and northern Siam which he describes.[1] This would appear to be another excellent example of the virtually insular character which the geographical variations of some of the birds of this region demonstrate.

Specimens taken above 6,000 ft. have rather longer and stouter bills, (26–28 mm. as against 24–25 mm.) and as a rule, have less brown on the throat and upper breast than those from lower altitudes. There are no other differences that I can discover, however, and I do not consider that those mentioned above are of sufficient importance to merit formal description.

Myiophoneus caeruleus caeruleus (Scopoli)

2 ♂ 2 ♀ Mt. Angka (4300 ft.) 6, 7, 8, 15 March

These specimens have black bills and are otherwise indistinguishable from a series from Fukien, China, which is typical *caeruleus*. H. G. Deignan, who has described *M. c. rileyi*, a yellow billed form, as the breeding bird of Mt. Angka (Proc. Biol. Soc. Wash., **51**, 1928, p. 25) writes me that the black billed form is "definitely only a migrant in Siam, present from October to March."

Pomatorhinus schisticeps nuchalis Tweeddale

5 ♂ 1 ♀ Mt. Angka (4300 ft.), 27 Feb., 9 March, 13 March
2 ♀ Mt. Nangkao (2800 ft.) 12 April

The specimens from Mt. Angka agree perfectly with a specimen of *nuchalis* from Maymayo in southeastern Burma. They are smaller than *olivaceus* (wing 86–90) and they have olivaceous rather than grey heads, which seems to me to be a much better character to distinguish *schisticeps* from *nuchalis* than streaks on the sides.

[1] Proc. Biol. Soc. Wash., 51, 1938, p. 90.

The two females from Mt. Nangkao differ from the Mt. Angka series in being somewhat browner on the back and in having less rufous at the back of the neck. Since there is one bird in the Mt. Angka series which also has a small bill and less rufous at the back of the neck, I suspect that these characters might disappear in the range of individual variation if a larger series were at hand.

Though it may yet be necessary to revise our opinions, it would appear safe enough at present to consider *nuchalis* and *olivaceus* as subspecies of *schisticeps* as de Schauensee has done.[1]

Stachyris nigriceps yunnanensis La Touche

3 ♂ 1 ♀ Mt. Angka (4300 ft.) 6, 8, 17 March
1 ♂ Mt. Nangkao (2800 ft.) 16 April

Examination of large series in the American Museum of Natural History proves this population to be identical with that of northern Tonkin, and though somewhat paler below than *yunnanensis*, thus showing an approach to *davisoni*, it is referable to *yunnanensis*. These populations have very black heads, unlike *davisoni*, which has the head somewhat more brownish olive, as has typical *nigriceps* and *coltarti* of upper Assam. The last differs from all other forms in having a darker throat and a clearer brown upper breast.

The post mortem change is very striking in this group, old skins, as usual, becoming browner and less olivaceous. The three specimens from Tenasserim, for example, are browner above and below than the series from Siam and Tonkin. The former, however, are older skins (1924) and it seems very probable that they have foxed.

Wing ♂	Tail	Wing ♀	Tail
coltarti			
Margherita, Assam			
59	48	61	51 (Type)
59	50		
Laising and Hungunn, N. Cachar			
58	51	57	49
davisoni			
Taok Plateau, Tenasserim			
60	55		
59	51		
58	52 (sex?)		

[1] Proc. Acad. Nat. Sci. Philad., 86, 1934, p. 185

Mt. Tahan, Pahang, Malaya

60	50	60	49
61	51	59	47.5
62	53	57	48
63	53	60	48
63	50		

yunnanensis

Hokow & Loukouchai, E. Yunnan

Wing ♂	Tail	Wing ♀	Tail
59	51 (Type) M.C.Z.		
61	53		

Chapa, Tonkin

62	56	62	52
63	55 sex ?		
60	54 " "		
63	56 " "		
60	53 " "		

Hoi Xuan & Lung-Lunh, Annam

63	55
60	55
61	54
59	51 sex?

Mt. Angka, Siam

60	56
60	56
62	55
62	53

Mixornis gularis sulphurea (Rippon)

3 ♂ 1 ♀ (juv.) Mt. Nangkao (2800 ft.) 8, 10, 13, 15 April

Kloss (Ibis, 1918, p. 206) and de Schauensee have shown (Proc. Acad. Nat. Sci. Phila., **86**, 1934, p. 192) that Gyldenstolpe's *minor* does not differ from the bird of the southern Shan States, and that the northern Siamese bird must, therefore, be called *sulphurea*.

The bird of southern Yunnan is indistinguishable from *M. g. lutescens* Delacour and Jabouille. This form is much more richly colored (particularly above) than *sulphurea*.

Specimens examined: 2 males 2 females, Hokow, Yunnan, 15, 22, 27 March, 1 April; 1 male 1 female, Muong Moun, Tonkin, 28 March, 7 April; 1 male 1 female, Koon Tan, N. Siam, as well as the series from Mt. Angka.

ALCIPPE FRATERCULA FRATERCULA Rippon

4 ♂ 2 ♀ Mt. Angka (4300 ft.) 4, 11, 12, 13, 24, 30 March
4 ♂ Mt. Nangkao (2800 ft.) 15, 18, 21 April

These specimens agree perfectly with series from Tenasserim in the Rothschild collection. I have followed Ticehurst (Ibis, 1935) in considering *fratercula* to be a distinct species, at least for the time being.

Wing	Tail	Bill	Wing	Tail	Bill
		Mt. Nangkao, Siam			
63	60				
62	60	15			
61	59	15			
62	61	15			
61	61	15			
		Mt. Angka, Siam			
60	60	15	63	61	16
65	61	15	64	61	15
65	63				
		Phong Saly, Laos			
60	54(worn)	15	62	61	14

ALCIPPE POIOCEPHALA HARINGTONIAE Hartert

1 ♂ 1 ♀ Chieng Dao, 23 Feb.
6 ♂ 3 ♀ Mt. Nangkao, 9, 13, 15, 16, 20, 23 April

This series agrees perfectly with series from Tonkin and also with the type series of *haringtoniae* Hartert, which has been examined in the American Museum of Natural History in New York. We are, therefore, left with no choice but to call this population *haringtoniae* in spite of the fact that Ticehurst (Ibis, 1935, p. 51, 52) has found that topotypical populations contain intermediates. *Alcippe poiocephala alearis* Bangs and Van Tyne must be relegated to synonomy.

There is not enough material at hand to make conclusive comparisons with the other races, *davisoni*, *phayrei*, *karrenni* and *fusca*. Three

specimens[1] of *karrenni,* however, differ from *haringtoniae* in having the coronal stripes less clearly marked and in being somewhat browner on flanks and rump.

Chieng Dao (1280 ft.) and Mt. Nangkao, Siam

Wing	Tail	Bill	Wing	Tail	Bill
69	70	16	66	69	
69	68	16	67	67	15
67	68	16	67	68	15
70	70	16	66	67	16
69	67	16			
68	69	16			

Pseudominla castaneiceps exsul (Delacour)

11 ♂ 5 ♀ Mt. Angka (8100 ft.) 17, 22, 24, 25, 28 March

Comparison with a large series of Indian birds in the Rothschild collection shows that, as usual in the Timaliidae, post mortem change has taken place, and that the older series are almost useless for subspecific identification. The situation is further complicated by the fact that very dark and very light males were collected on December 5, 1928 by Dr. Hugh M. Smith on Mt. Angka (8000 ft.). These facts make the recognition of Delacour's *exsul* difficult.

Siva strigula castaneicauda Hume

13 ♂ 12 ♀ 1 juv. Mt. Angka (8100 ft.) 22–31 March

As usual these birds are subject to post mortem change. Birds in worn plumage are much grayer than those in fresh plumage. It is clear, however, that birds of Yunnan and northern Tonkin have yellow ear coverts while those of the Chin Hills, northern Siam and Malaya 1 are grayish (much lighter in Burma than in Malaya). There is no material from Tenasserim available. Siamese and Tonkinese birds are somewhat more richly colored below than are *yunnanensis* and *castaneicauda,* but since the skins of the latter are much older it may be that the difference is due to post mortem change.

1 *s.c. malayana* Hartert.

[1] 1 Vin Pang (28 miles east of), Siam, Jan. 30, 1924, A. S. Vernay coll. (wing 70, tail 64)
1 Binhon, Thayet, Burma, Jan. 21, 1912, (wing 67.5, tail 63)
1 Maplay chong, Thaungyme, Tenasserim, Feb. 8, 1880, H. H. Harington coll. This specimen very worn and "foxed".

Cutia nipalensis nipalensis Hodgson

1 ♂ 1 ♀ Mt. Angka (7400 ft.) 31 March

These specimens do not differ from Indian birds.

Mesia argentauris galbana Mayr & Greenway

4 ♂ 3 ♀ Mt. Angka (4300–5700 ft.) 3, 5, 11, 13, 18 March

This well marked form was described in the Proc. N. E. Zool. Club, **17**, 1938, p. 3 (q.v.) as being somewhat greener on the back and in having considerably paler and more yellowish nuchal collar and underparts than other forms.

Aethorhynchus lafresnayanus innotatus (Blyth)

2 ♂ Mt. Nangkao (2800 ft.) 15, 20 April

These specimens have green tails and the outer webs of the primaries narrowly edged with green; the secondaries are almost entirely green. The ear coverts are tinged strongly with yellowish and the forehead of one is tinged with yellowish. The rump and upper tail coverts are green like the back. Both have very large and stout bills. In comparison with a single specimen from Darjeeling they are lighter, clearer green above and lighter, brighter yellow below. There is no yellow ring around the eye.

Measurements

	Siam	
Wing	Tail	Bill
73	59	25
73	60	25
	Nepal	
69	56	22

A large series of breeding specimens is needed to distinguish these two races (Stuart Baker Faun. Brit. Ind. **8**, p. 610).

Chloropsis hardwickii hardwickii Jardine & Selby

3 ♂ ad. 1 ♂ imm. 4 ♀ Mt. Nangkao (2800 ft.) 9, 10, 11, 12 April
2 ♂ Mt. Angka (4300 ft.) 3, 5 March

In view of the fact that wing measurements of males of this series average 93 mm. and females 87 mm., I am left with no choice but to

refer the birds to the nominate form. de Schauensee (1934, p. 200) has found that the birds in the vicinity of Chieng Mai are somewhat smaller (88.5 for males and 84.66 for females) and he refers them to *malayana*. *C. h. malayana* was described by Robinson and Kloss from Gunong Ijau, Perak, 4500 ft., so that it is not possible that the distribution is altitudinal.

A single specimen from Nepal is somewhat yellower, less green above, but does not differ in other respects from the series at hand. Its wing measures 94 mm.

Wings of males measure 95, 94, 90, 93, and females 87, 86.5, 86.5, 88 mm.

Criniger tephrogenys henrici Oustalet

1 ♂ 2 ♀ Mt. Angka (4300 ft.) 2, 14, 19 March
1 ♂ 1 ♀ Mt. Nangkao (2800 ft.) 12, 14 April
1 ♂ Mae Wan River near Doi Saket, 21 Feb.
1 ♂ Chiengmai, 23 Feb.

These specimens show variation from tawny brown to greenish gray with a slight yellow wash which almost bridges the difference between the two species *tephrogenys* and *gutturalis*.

Wings of males measure 108.5–112 and of females 105–108. Five specimens from Loukouchai in southern Yunnan measure 103–106 (males) and 104 (single female). Delacour (Ois. Indo-Chine F., p. 30, 31) gives measurements of 102–118 for males from northern Tonkin and 102–112 for males of his race *annamensis* of Annam and Cambodia, from which I think we may conclude that there is no great difference between the two races.

Collin and Hartert (Novit. Zool., 1927, p. 51) have shown that *Turdus gularis* Horsf. (1822) is preoccupied by *T. gularis* Lath. (1801). It would seem better to use the character and development of the nuchal crest rather than the color of the underparts.

Xanthixus flavescens berliozi Delacour

5 ♂ 3 ♀ Mt. Angka (2800–4300 ft.) 3, 5, 7, 9, 11, 13 March

This series agrees rather better with specimens from Laos and southern Yunnan than with birds of Karrenni and Bahmo, which have been compared in the American Museum of Natural History. Siamese and Indo-Chinese birds are as a rule darker and more greenish on the

breast and richer more golden yellow on the flanks and under tail coverts. Neither *vividus* Baker nor *berliozi* are well marked forms, however.

Measurements. Southern Yunnan (Loukouchai) 90; Laos (Phong Saly) 87; Siam (Mt. Angka) 84–89; Burma (Thoudoung, east of Toungoo) 83–89; Burma (Bahmo) 84–86.

Otocompsa jocosa erythrotis (Bonaparte)

2 ♂ 1 ♀ 1? Chiengmai, 17, 23 Feb.
1 ♂ Chiengdao, 18 Feb.
1 ♂ 1 ♀ Mt. Angka (4300 ft.) 3, 13 March
1 ♂ Mt. Nangkao (2800 ft.) 18 April

These specimens are at once separable from a series of eight specimens from Yunnan (Hokow, Loukouchai), which we may take to be representative of *jocosa*, by the whiter, less brownish gray underparts. The difference is striking. Two skins from Koon Tan, N. Siam are, however, marked with grayish brown on the flanks and are scarcely to be distinguished from Yunnanese birds. I do not think that the character of lighter back is to be relied upon because of seasonal variation and post mortem change. Specimens from India (*emeria*) are at once distinguishable by the longer red plumes beneath the eye.

Pycnonotus cafer klossi Robinson

3 ♂ Mt. Nangkao (2800 ft.) 19, 22 April

Not only have specimens from Siam smaller bills, as de Schauensee has remarked (Proc. Acad. Nat. Sci. Phila., **86**, 1934, p. 205) but they have shorter wings. A series from Yunnan measures 98–102 mm. for males and 95–96 for females. The series listed above measures 91–94, and a pair of topotypes (Koon Tan) 89 and 86 mm.

Ixos flavula hildebrandi (*sic*) (Hume)

1 ♂ Mt. Angka (4300 ft.) 1 March
1 ♂ 2 ♀ Mt. Nangkao (2800 ft.) 20, 21 April

The specimens from Mt. Nangkao have rather brownish heads but the male from Angka has a very black head and compares very closely indeed to specimens of *bourdellei* from Phong Saly, collected by Van Tyne in April. A pair from Doi Chieng Dao which de Schauensee

collected in January have also very black heads and compare closely to *bourdelli* in this respect. All Siamese specimens have grayer and darker underparts than my specimen of *bourdellei*, however.

Iole olivacea propinqua (Oustalet)

2 ♂ 1 ♀ Mt. Nangkao (2800 ft.)
1 ♀ Chieng Dao, 23 Feb.

Wings of males measure 88,90 mm. and those of females 84,85 mm. They are identical with a series from Laos (wings 84–88). A female from Szemao in southern Yunnan is yellower, not so gray on the breast; the wing measures 92 mm.

Microtarsus atriceps cinereoventris (Blyth)

1 ♂ 1 ♀ Chieng Dao, 26 April (wing 79, 80)
1 ♀ Chieng Dao 26 April (in gray phase) (wing 81)

This is the first record, as far as I can discover, of the gray phase of this species in Siam. This specimen has the breast gray with indistinct yellow edges to the feathers. The name *cinereoventris* is here used for the slightly larger, northern form of *atriceps* and does not imply that the gray phase is considered to be anything more than a mutation.

Mr. Chasen has written me as follows: "I agree that *Brachypodius cinereoventris* is a mutation. . . . It has not yet been shown that birds from Cachar (type loc. of *major*) differ from those of Tipperah (type loc. of *cinereoventris*) and it is highly improbable that they do so."

Brachypteryx cruralis cruralis (Blyth)

18 ♂ 6 ♀ Mt. Angka (8100 ft.) 24, 25, 30 March

Males in this series are uniformly gray on the belly. This character is quite unstable in series from China. In size these Siamese birds are identical with Indian birds and there are no other observable differences, except the grayness of the belly. This I believe to be a familial character which has arisen in small populations of these birds, isolated as they usually are.

Birds from China are slightly larger than those from India, Siam and Tonkin. There are no other differences. Chinese birds will therefore have to be called *B.c. formaster* Thayer and Bangs, which form was described from Wa Shan, a locality about 70 miles south east of Tat-

sienlou in Szechuan. The form from Mongtz, southern Yunnan, described as *B.c. laurentei* La Touche (1921) must be relegated to synonomy.

Measurements of Wings

Darjeeling and Sikkim (Rothschild coll.)	
Males (4)	Females (3)
69.5–72	64–66
Tonkin	
Males (4)	Females (3)
68–72	65–68

Delacour gives 56–70 for 37 examples from Tonkin.

Siam	
Males (18)	Females (6)
68.5–72	64–69
Southern Yunnan	
Males (3)	
71–73	
Likiang Range, Yunnan	
Males (4)	Females (2)
71–73	69
Washan, western Sechuan	
Males (Type of *formaster*)	Females (3)
74	67–71

Kinnear (Ibis, 1937, p. 267) states that males collected in Bhutan are dimorphic, being either brown or blue and that he has seen a male from Tonkin which is half blue half brown. I have sexed brown specimens as males in Laos and Tonkin. The testicles were very small however and the size small, as in females. It would seem more probable that the immature plumage is held over for more than a year in this species.

BRACHYPTERYX LEUCOPHRIS NANGKA Riley[1]

2 ♂ Mt. Angka (4500, 6000 ft.) 1 March, 7 April
1 ♀ Chieng Dao (1280 ft.) Feb.

These specimens are somewhat darker than the types of *carolinae* La Touche of Fukien, but the difference might easily be due to a post mortem change, which is so very apt to occur especially where this

[1] Proc. Biol. Soc. Wash., 45, 1932, p. 59.

particular shade of olive brown is concerned. This race is very doubtfully retained.

For remarks on this species see Rothschild, Novit. Zool., **33**, 1926 p. 270; Delacour and Jabouille, Arch. Hist. Nat., Paris, **3**, 1927, p. 146; Robinson, Birds of the Malay Peninsula, **2**, 1928, p. 220.

Chaimarrornis leucocephala (Vigors)

1 ♀ Mt. Angka (4300 ft.) 27 Feb.

As Stuart Baker remarks, Chinese birds do seem to be larger. I think, however, that if the sexing of skins were correct that there would not be the overlap in size that now appears and that birds from Kansu, Szechuan and Hupeh would be found to be larger than birds from southern Yunnan, Tonkin and Siam.

India (Punjab) sexed by W. Koelz	
1 ♂	1 ♀
100	87
Siam and Shan States sexed by de Schauensee	
2 ♂	1 ♀
101, 98.5	86
Southern Yunnan (Mongtz, Loukouchai) sexed by Kobayashi	
8 ♂	5 ♀
90, 91, 90, 98, 90, 100 98, 95	95, 94, 98, 88, 89
Kansu, Tibet (Przewalski and Rock, collectors)	
4 ♂	1 ♀
92, 101, 104, 105	95
Hupeh (Ichang) sexed by W. Zappey	
3 ♂	2 ♀
104, 104, 106	91, 91

Tarsiger cyanurus cyanurus (Pallas)

1 ♀ Mt. Angka (8100 ft.) 30 March

Females of *cyanurus* can be distinguished from those of *rufilatus* by the paler breast and the white marking in the throat, which is wider and extends into a "bib" on the upper breast. This is well illustrated

by three females taken on the Lena River in September, which represent the race *ussuriensis* and a long series of winter birds from China.

Tarsiger cyanurus rufilatus (Hodgson)

3 ♀ Mt. Angka (8100 ft.) 23, 28 March

One of these specimens has bright shiny blue upper tail coverts, not smoky gray like the other two and the forehead is blue. It may be that this is a juvenile male.

Rothschild (Novit. Zool., **32**, 1925, p. 298) with large series, finds that the race *practicus* Bangs of southern Yunnan "is a very poor subspecies," though he continues to recognize it in 1926 (p. 253). Baker synonymizes it without appearing to understand the differences as pointed out in the original description, for he says (Faun. Brit. Ind., Birds, **2**, p. 98) that *practicus* was described as being darker, whereas it was actually described as being somewhat lighter and grayer. Material from India in the British Museum proves it to be separable by just this character. See also Delacour, Oiseau, **10**, 1940, p. 157.

Turdus obscurus obscurus Gmelin

5 ♂ Mt. Angka (8100 ft.) 22, 28, 29 March
1 ♀ Mt. Angka (4300 ft.) 3 April
1 ♂ 2 ♀ Mt. Angka (5700 ft.)

There appear to be three types of plumage in this series. Specimens A, B, C, a male and two females taken at 8100, 5700 and 4300 ft., are typical of *obscurus*, of which there are breeding specimens from Siberia in this museum. The male has a white chin but the throat and breast are gray, the feathers with concealed white bases.

Specimens D and E, a pair taken at 5700 ft., have a line of white, speckled with grayish brown extending from the chin to the upper breast.

Specimens F–I, males taken at 8100 ft., resemble females of typical *obscurus* except that they are somewhat darker and grayer on the breast. Their tails are slightly shorter.

All specimens differ from *chrysolaus*, of which I have seen two topotypical males from Sachalin Island, in having a distinct white supraocular stripe and in being slightly larger. Specimens D and E have the first primary wider and longer as in *chrysolaus* (see Hartert, Vog. Pal. Faun., **1**, page 656).

Turdus o. subobscurus Salvadori, which is known from a single

specimen from Tenasserim, is said to be larger than *obscurus* and with a different wing formula, the 3d and 4th primaries being subequal and longest and the 2d between the 5th and 6th. It is curious that this is the formula of *chrysolaus* as well. From descriptions of *subobscurus* it would appear that it is somewhat larger than *chrysolaus* (wings measure 130 as against 135), that both lack the supraocular stripe, that they are both paler than *obscurus,* but they differ from each other in the color of the throat which is gray in *subobscurus,* while in *chrysolaus* it is white streaked with gray.

It may be that with larger series it will be found that the color of the throat is due to age or individual variation, in which case *subobscurus* would be a rather large specimen of *chrysolaus* in winter quarters; it was collected on March 8. On the other hand there may still be unknown populations.

Measurements

Male			Siam	Female		
Wing	Tail			Wing	Tail	
128	86	Spec. A		121	75	Spec. B
126	87	" D		121	77	" C
123	80				85	" E
124	81					
124	79					
125	80					
			Sachalin Island (*chrysolaus*)			
119	78					
121	81					
			Siberia			
128	85			115	75	

Zoothera marginata parva Delacour

1 ♂ 1 ♀ Mt. Angka (8100, 5700 ft.) 17, 23 March
1 ♀ Mt. Nangkao (2800 ft.) 17 April

I have no material of this rare bird for comparison but Stuart Baker gives measurements of the culmen of *marginata* as 28–29 mm., while Delacour gives 22–25 for his race. My birds measure 23–25 mm.; a female from Chapa, Tonkin and a pair from Laos measure 26 mm.

Monticola solitaria pandoo (Sykes)

1 ♂ Chiengmai, 24 Feb.
1 ♂ Mt. Angka (4300 ft.) 4 March

The bird from Mt. Angka is very dark blue without a trace of chestnut and with scarcely a trace of the gray tips to the feathers. The Chiengmai bird on the other hand compares very closely to birds from Yunnan. They are also bright blue with scattered gray tipped feathers and a little chestnut on the under tail coverts. They are all somewhat darker blue and with less gray and chestnut than *affinis*.

Cochoa purpurea Hodgson

1 ♀ Mt. Saket (1280 ft.) 23 Feb.

This constitutes the first record of this bird for Siam. The discovery is not surprising, however, for Delacour has recorded it from the center and the northwest of Tonkin (Ois. d'Ind. Chine Franc., **3**, p. 143) and its known range previous to that was from Assam through the hills of central and south Burma to Tenasserim (Baker, Faun. Brit. Ind., **2**, p. 184).

Muscicapula hodgsonii (Verreaux)

4 ♂ 7 ♀ Mt. Angka (4300–8100 ft.) 26 Feb. 2, 6, 7, 26, 31 March

These specimens differ in no way from long series from Kansu, Szechuan and Yunnan. As might be expected, birds taken in the autumn, in worn plumage, are somewhat paler than those taken in spring.

Muscicapula hyperythra hyperythra (Blyth)

6 ♂ 2 ♀ Mt. Angka (8100 ft.) 22, 23, 24, 28 March

There is no difference between these birds and series from northern Cachar (Guilang) and upper Assam (Margherita) which have been examined in the American Museum of Natural History. Females are somewhat more olive, particularly on the back, but this is undoubtedly due to post mortem change.

Muscicapula melanoleuca melanoleuca Blyth

1 ♂ Mt. Angka (4300 ft.) 12 March

Apparently de Schauensee and Chasen are agreed that the bird of Mt. Soutep is *melanoleuca*, not *westermanni* (Proc. Acad. Nat. Sci. Philad., **86**, 1934, p. 214; Journ. Siam Soc., Nat. Hist. Suppl., **8**, 1932, p. 239).

Muscicapula banyumas whitei (Harington)

5 ♂ 5 ♀ Mt. Nangkao (2800 ft.) 9, 13, 16, 17, 20 April

Though these specimens differ slightly from typical *whitei* of northern Burma[1] the differences are too slight for formal recognition. In series the breast appears to be more sharply defined; the brown does not extend down to the flanks. de Schauensee, who examined this series with me in Philadelphia, agrees with me as to the identification.

8 ♂		Siam	2 ♀	
Wing	Tail		Wing	Tail
58–61	39–43 (av. 40)		55.5	36
		Yunnan (Mongtz)		
6 ♂			8 ♀	
60–61	41–45 (av. 42–4)		58–60	37–39
		Yunnan (Tao-mung-Chung, Likiang Dist.)		
2 ♂				
63	44–45			
		India		
55–63 (Baker)	38–40 (Baker)			
		Assam		
1 ♂			1 ♀	
59	40		57	40

Muscucapula hainana (Og. Grant)

1 ♂ Mt. Nangkao (2800 ft.) 11 April

Alseonax latirostris latirostris (Raffles)

These specimens do not differ to any great extent from Siberian examples (*poonensis*). They are slightly grayer on the breast but otherwise do not differ at all. Specimens from Yunnan are quite indistinguishable.

[1] Material examined from the type locality, from southeastern Yunnan and from other localities in northern Siam shows that the populations are identical.

Males			Females		
Wing	Tail		Wing	Tail	
		Siberia, Mongolia, northern China			
71	52	(No. Mongolia)	74	53	(W. Siberia)
71	50	(Shansi)	72	50	(S. ")
		Yunnan (Mongtz, Loukouchai)			
74	51		71	51	
70	47		67	48	
67	47		66	45	
68	49		68	48	
71	51				
		Siam			
71	49		68	48	
67	50		67	47	

Niltava grandis grandis (Blyth)

7 ♂ 6 ♀ Mt. Angka (4300-8100 ft.) 17 Feb., 1, 17, 22, 23 March

The described forms of this species are as follows:

Niltava g. grandis (Darjeeling)
" " *decipiens* (Sumatra)
" " *decorata* (Annam)
" " *nobilis* (Mt. Angka, Siam)
" " *griseiventris* (Yunnan)

Long series of *grandis* in the British Museum show a wide range of individual variation in the color of the head and nuche which may be brown or blue in females. Birds from Laos as well as northern Siam prove to be *grandis*. Of these forms only *grandis, decipiens* and *decorata* can be maintained.

Between males there is no discoverable color difference which is not ascribable to age. Paleness and grayness of the underparts is due usually to immaturity; most grayish specimens having the under tail coverts brownish or tipped with brown, or sometimes whitish. Males of *decipiens* are, however, smaller than *grandis*.

Material examined in A.M.N.H. and measurements:

decipiens

5♂ 7♀ Sumatra: Delhi, Bandar Baroe and Karinchi (in the Barison Mts.)

Wings of males 92–96 mm.

4♂ 3♀ Malaya: Gunong Tahan, Semangko Pass, Selangor, Gunong Ijau, Perak
Wings of males 94–96 mm.

"nobilis"

3♂ 7♀ Tonkin: Fan-si-pan range, Chapa
Wings of males 104–112 mm.
1♂ 1♀ Southern Shan States: Mong-Kong

"nobilis"

7♂ 6♀ Siam: Mt. Angka
Wings of males 102–107 mm.

"griseiventris"

2♂ Southeastern Yunnan: Loukouchai
Wings of males 101–102 mm. (Type)

"grieiventris?"

2♂ Yunnan: Tengueh, Schweli-Salween divide
Wings of males 104, 112 mm.

decorata

2♂ 1♀ Cochin China: Langbian Peak, Djiring, Annam
Wings of males 97–100 mm.

grandis

7♂ 5♀ India: Sikkim, Darjiling, Upper Assam, Manipur, N. Cachar
Wings of males 102–108 mm.

Rhipidura albicollis albicollis (Vieillot)

2 ♂ 2 ♀ Mt. Angka (4300–6000 ft.) 3, 5, 12 March
1 ♀ Mt. Nangkao (2800 ft.) 14 April

Examination of large series in the American Museum, New York and the British Museum shows that *celsa* Riley cannot be naintained.

Cyanoptila cyanomelana cumatilis Thayer & Bangs

1 ♂ Mt. Nangkao (2800 ft.) 8 April

This single specimen is only provisionally referred to the above form for it is different from any specimen of the Chinese bird in the collections of the Museum of Comparative Zoölogy or the American Museum of

Natural History. Since there is a certain amount of individual variation in this form and since we do not know where the bird breeds or indeed anything about it, it would not appear to be wise to describe it here.

I cannot find that this form has ever before been taken in Siam.

Lanius nigriceps nigriceps (Franklin)

2 Mt. Angka (4300 ft.) 3, 9 March

The upper back of these specimens is grayish, but they are intermediate in size between *nigriceps* and *longicaudatus* Og. Grant of southern Siam.

	♂		♀	
	Wing	Tail	Wing	Tail
Southern Yunnan (Mongtz)	100	127	94	121
	96	118 (worn)	97	122
			99	126
			96	125
Siam (Mt. Angka)			96	130
			98	120 (worn)
Siam (Bangkok)	97	153	95	136

Hemipus picatus capitalis McClelland

1 ♂ Mae Wan River near Mt. Saket, 21 Feb.
1 ♂ Mt. Angka (4300 ft.) 3 March
5 ♂ 2 ♀ Mt. Nangkao (2800 ft.) 11, 13, 14, 16 April

Although it appears likely that this brown backed form and the black backed form are only phases of plumage, still only field work can prove this to be so. Every specimen in this series has a brown back.

Pericrocotus flammeus elegans McClelland

1 ♀ Chieng Mai, 23 Feb.
1 ♂ Chieng Dao, 20 Feb.
2 ♂ Mt. Saket, 23 Feb.
1 ♂ 2 ♀ Mt. Angka (4300 ft.) 3, 14 March
3 ♂ Mt. Nangkao (2800 ft.) 14, 15, 17 April

These specimens differ from *P. f. bakeri* La Touche of southern Yunnan and Laos in having the entire outer web of the central tail feathers red, not black edged with red. They are also slightly smaller.

♂		♀	
Wing	Tail		
Mt. Nangkao (2800 ft.)			
97	87		
95	86		
94	86		
Mt. Angka (4300 ft.)			
96	89	96	85
		94	86
Mt. Saket (1280 ft.)			
95	90		
Chieng Dao			
94	92		
Koon Tan & Chieng Mai			
95	88	94	89
		97	92
Yunnan (Loukouchai)			
102	95.5 (cotype)	100	100 (cotype)
Laos (Muong Moun)			
100	100	97	95

Chaptia aenea aenea (Vieillot)

2 ♂ 2 ♀ Mt. Angka (4300 ft.) 12 March
1 ♂ 1 ♀ Mt. Nangkao (2800 ft.) 16 April

These specimens from their size would appear to be *aenea*, not *malayensis* which Deignan records from north Siam (Journ. Siam Soc., Nat. Hist. Suppl., **10**, 1936, p. 101)
Wings of males measure 122, 125, 125 and tails 118, 120, 118.
Those of females measure 123, 117 and 115, 112.

Tribura thoracica thoracica (Blyth)

1 ♀ Mt. Angka (4300 ft.) 3 March

This specimen is very close to birds of the Likiang District, Yunnan. It differs slightly, however, in having the breast more brownish. From

Tribura thoracica davidi La Touche of southern Yunnan, it differs, as do northern Yunnanese specimens, in its longer tail and darker color.

Eastern forms of *Orthotomus sutorius*

The forms with which we are here concerned are as follows: *O. s. patia* Hodgson 1845 (t. l. Nepal), *O. s. longicauda* (Gm.) 1788,[1] *O. s. inexpectatus* La Touche 1922 (t. l. Mongtz, southern Yunnan). A number of forms have been described from India by W. Koelz (Proc. Biol. Soc. Washington, **52**, 1939, p. 70) of which I have no material.

From the material at hand it would appear that typical *longicauda* differs from all other forms in its buffy underparts; that *patia* (assuming that northern Cachar birds are *patia*) differs in its buffier, not as grayish, ear coverts, and that topotypical *maculicollis* is a very dark form with the feathers of the ear coverts almost black with silvery shaft stripes. *Inexpectatus*, therefore, differs from *longicauda* in its grayer, not buffy, underparts, from *patia* in its grayer, less buffy, ear coverts, and from *maculicollis* in its grayer, not blackish, ear coverts. It is also somewhat brighter and darker green above than *longicauda* or *patia* but not as dark as *maculicollis*. Birds from northern Siam and northwestern Laos belong to this race.

Although birds from southern and eastern Siam are a trifle paler than *inexpectatus* I do not think that the difference is sufficient for formal description. Skins from peninsular Siam are intermediates, *maculicollis* ± *inexpectatus*, though they show an approach to the more northerly populations in their slightly paler coloration. There is considerable variation.

A pair from Mt. Victoria are extremely pale.

Measurements: Fukien ♂ 45–46, ♀ 44–45; southern Yunnan ♂ 46–51, ♀ 44–47; northern Siam ♂ 42–46, ♀ 40–44; central Siam ♂ 44–46, ♀ 42–44; northwestern Laos ♂ 44, ♀ 41; northern Cachar ♂ 44, ♀ 41–44; Malaya ♂ 45–48; Peninsular Siam ♂ 44–46, ♀ 43.

Seasonal variation: Birds shot in April and May are brighter chestnut on the forehead and somewhat brighter green on the back. The extremely elongated central tail feathers (15–20 mm. longer) appear to be acquired in early April and may be retained in a worn condition until August.

Sexual variation: I do not think it is always possible to distinguish males from females after the post nuptial molt. I cannot find that

[1] Phyllorapheus Swinhoe 1860, described from Amoy is a synonym. I hereby restrict the type locality of *longicauda* to Amoy.

the ear coverts vary with sex as has been suggested. Birds of the year have a more rounded first primary.

Material examined: 14 ♂ 7 ♀ Mongtz, southern Yunnan (all seasons of the year); 2 ♂ 2 ♀ 2 ? Foochow, China (February, April, October, December); 1 ♂ 3 ♀ Gunyon, northern Cachar (March, July, December); 3 ♂ 1 ♀ Selangor, Perak, Malacca and Kuantan sea coast, Malaya (January, March, May, December); 10 ♂ 8 ♀ Bangkok, Kan Buri, Siam (April, May, June, September, October, December); 4 ♂ 4 ♀ Ban Wang Lung, Ban Nam Kien, Mt. Nangkao, northern Siam (January, April, October); 2 ♂ 1 ♀ Tuong, Bang Nana, Peninsular Siam; 2 ♂ 2 ♀ Muek-Lek, Pak-Chong, Lat-Boua-Kao, eastern Siam.

Remarks: There has been a good deal of confusion in this group due to the poorly marked characters of the subspecies and the paucity of material from topotypical localities in muse ms.

La Touche described *inexpectatus* in 1922, Kinnear synonymized it with *longicauda* in 1929, Delacour followed him in 1930, Ticehurst in 1938, and Delacour and Greenway in 1940, while Bangs (1929 and 1930) continually maintained its validity. There can be no doubt that Bangs was right.

The series at hand is possibly inadequate. Even with six specimens, representative of every season, from Fukien, it may be found that the more buffy underparts, apparently diagnostic in this series, may disappear with more material.

Phylloscopus davisoni davisoni (Oates)

3 ♂ Mt. Angka (4300, 8100 ft.) 6, 22, 29 March

These specimens have the characteristic white inner webs to the outer rectrices. They have been kindly identified by Dr. Ticehurst in London.

Phylloscopus reguloides assamensis Hartert

9 ♂ 1 ♀ Mt. Angka (8100 ft.) 22, 23, 24, 29, 30 March

This series was also identified by Dr. Ticehurst but apparently with some doubt for he says "I cannot make anything else of them." They are all very dark and stained, probably by a forest fire of which the collecting party wrote.

Phylloscopus maculipennis maculipennis (Blyth)

2 ♂ 2 ♀ Mt. Angka (8100 ft.) 22, 30 March

These birds are slightly smaller than measurements given by Hartert and by Ticehurst but not smaller than those given by Stuart Baker. Wings of males measure 45, 46, and tails 33, 35; those of females 45, 47 and 32, 33.

Ticehurst (1938, p. 122) considers *debilis* to be a synonym of *maculipennis*. This species seems never before to have been recorded from Siam. Delacour records it from the border of Tonkin and Yunnan on the Fansipan range, however.

Phylloscopus pulcher pulcher Blyth

5 ♂ 1 ♀ Mt. Angka (8100 ft.) 24, 25, 27, 30 March

Ticehurst finds (1938, p. 98), that *vegetus* Bangs of Yunnan can be nothing by a synonym of *pulcher*. The differences noted are in his opinion and mine due to post mortem change.

Siamese birds at hand agree perfectly with a series of Yunnanese examples.

Wings of males measure 56.5–61 and tails 42–44.

Phylloscopus trochiloides trochiloides (Sundevall)

1 ♂ 1 ♀ Mt. Nangkao (2800 ft.) 8, 18 April

These birds are in very worn plumage and are moulting. They measure 55, 64 (wing); 44, 51 (tail); 15 (bill from base). They are assigned with some doubt to this species, though they are closest to it.

Abroscopus albogularis hugonis Deignan

1 nestling ♀ Mt. Nangkao (2800 ft.) 9 April

This is the southern-most record for this form. Stanford and Ticehurst (1935) record it from northern Burma.

Zosterops palpebrosa joannae La Touche

2 ♂ 3 ♀ Mt. Nangkao (2800 ft.) 8, 13, 14, 15 April

Since writing his last paper on Zosterops (Journ. f. Orn., **87**, 1939, pp. 156–164), Stresemann, having seen topotypes of *Zosterops palpebrosa joannae* and many specimens collected by Deignan in Siam, has changed his mind. He writes on August 25, 1939 to James Peters:

"*Palpebrosa* from Mengtz, called *joannae* by La Touche, is very near to *mesoxantha* Salvadori, but has the flanks a slightly darker grey and the upperside more greenish, less yellowish. The name *joannae* may stand, therefore, but the racial characters are very feebly pronounced."

Stresemann does not make it clear whether or not he now considers *mesoxantha* to be separable from *palpebrosa,* with which he synonymized it (op. cit. p. 163). I have not seen *mesoxantha,* which was described from Karrenni, but the northern Siamese specimens listed above are quite as dark as *joannae* and otherwise inseparable; they are paler and yellower on the back than *Zosterops* (*japononica* ?) *simplex* with which *joannae* occurs in southern Yunnan at all seasons. Specimens from Tonkin and Laos are also inseparable from *joannae.*

Seasonal variation in this form is slight but to be noticed, birds killed in March and April being somewhat darker and greener on the back than those taken in November and December. Individuals may or may not have a faint yellow line down the middle of breast and belly.

Material examined: 9 ♂ 7 ♀ Mongtz, southern Yunnan; 6 ♂ 3 ♀ Xieng Khouang, Taloun, Lo-Tiao, Laos, as well as long series of *simplex* from these places.

Chalcoparia singalensis interposita Rob. & Kloss

2 ♂ 1 ♀ Chieng Dao, 20 Feb., 28 April

These two males are indistinguishable from two males from Laos, which on geographic grounds should be *koratensis* (t. ll. E. Siam). Exactly as Robinson and Kloss described *interposita* (Journ. Fed. Malay St. Mus., **10**, 1921, p. 209; t.l. Peninsular Siam) Laotian males have the rufous of the foreneck extending over the upper breast and ending gradually. The remaining lower parts are quite as bright yellow. I have recorded these specimens as *interposita* because there is not enough material at hand to do otherwise than follow. Series should be examined.

Arachnothera longirostris longirostris (Latham)

1 ♂ 1 ♀ Mt. Angka (4300 ft.) 3, 4 March
1 ♂ 1 ♀ Mt. Nangkao (2800 ft.) 11, 19 April

Though I have seen no specimens from India, it would appear that the validity of *sordida,* La Touche (Bull. B.O.C., **42**, 1921, p. 32) which seems to have been based on the shorter bill, is very doubtful.

Chasen (Bull. Raffles Mus., Singapore, **11**, 1935, p. 281) has synonymized *antelia* Oberholser (1923) of Peninsular Siam. Bills of Siamese birds measure 40.5, 40 mm. (male); 37, 36 mm. (female) while that of the type of *sordida* measures 36 mm.

Aethopyga nipalensis angkanensis Riley (1929)

34 ♂ 15 ♀ Mt. Angka (8100 ft.) 23, 24, 25, 28, 31 March

Two of these birds J. A. Griswold, Jr., the collector, reports were breeding. He writes "they were both collected with their nest which had no eggs in it. The nest was about twenty feet from the ground at the end of a small branch. In the two nests which I observed being built the female did all the work."

Blythipicus pyrrhotis annamensis Kinnear

1 ♂ Mt. Nangkao (2800 ft.) 15 April

This specimen is indistinguishable from Indo Chinese birds and differs from Indian birds by its brilliant red nuchal collar and the strong reddish tinge of the mantle.

Cyanops asiatica asiatica (Latham)

1 ♂ Chieng Dao, 23 Feb.
2 ♂ Mt. Angka (4300 ft.) 3, 9 March
2 ♂ 1 ♀ Mt. Nangkao (2800 ft.) 18 April

Schauensee (1934) records *davisoni* from northern Siam with the remark that all his specimens but one show a trace of blue on the vertex. One specimen at hand shows a faint trace of blue on the vertex as do many Indian specimens, but these have black vertices and are clearly referable to *asiatica*.

Merops orientalis birmanus Neumann

1 ♀ Chieng Dao, 24 Feb.
1 ♂ 1 ♀ Chiengmai, 16 Feb.

These specimens are indistinguishable from those from southern Yunnan. It may be that this bird should be called *ferrugiceps* Anderson (see Rothschild Nov. Zool., **33**, 1926, p. 244). Peters tells me that the validity of this name depends on the adequacy of the bibliographic

reference used by Gray in citing the name as a synonym in the Catalogue of the Birds of Nepal, 1846, p. 58. I have not seen this paper.

Ceryle lugubris guttulata Stejneger

1 ♂ 3 nestlings Mt. Angka (4300 ft.) 14 April

Batrachostomus hodgsoni indochinae Stresemann

1 ? Mt. Angka (4300 ft.) 17 April

This is unfortunately a juvenal bird so that any accurate subspecific identification is impossible. It is, however, the first time that this species has been taken in northern Siam. There cannot be much doubt that Stresemann's surmise that this form occurs in Karrenni is correct (Mitt. Zool. Mus. Berlin, **22**, 1937 p. 320).

Otus spilocephalus latouchi (*sic*) (Rickett)

1 ♂ Mt. Angka (4300 ft.) 7 April

This specimen agrees well with birds from northern Tonkin and northern Annam. There is a certain amount of individual variation in the spotting of the underparts and the lightness or darkness of the breast. It is slightly paler than a specimen from the region of the Chindwin (*vide* Mayr, Ibis, 1938).

The wings measure Siam 144 mm., Tonkin (Chapa) ♀ 158, Tonkin (Laokay) ♂ 146, Annam (Hoi Chuan) ? 144.

Otus sunia modestus (Walden)

1 ♂ juv. Chiengmai, 29 April

Apparently this bird had just come out of the nest a month or so before it was collected. But for the fact that two mature feathers molting in on the breast show the characteristic black central streak of this species, the bird might be a gray phase of *spilocephalus*.

Huhua nipalensis nipalensis (Hodgson)

1 ♂ Mt. Angka (4300 ft.) 8 April

Phodilus badius saturatus Robinson

1 ♂ Mt. Nangkao (2800 ft.) 12 April

Wings measure 210 mm., sec., Robinson, B.B.O.C., **47**, 1927 (see p. 121)

Spilornis cheela burmanicus Swann

1 ♂ Chiengmai, 26 Feb.

Columba pulchricollis Blyth

1 ♂ 1 ♀ Mt. Angka (8100 ft.) 29, 30 March

BIRDS FROM MT. KINA BALU, NORTH BORNEO

By James L. Peters

ACCIPITRIDAE

Accipiter virgatus virgatus (Temminck)

2 ad. ♂, 1 ad. ♀, 3100 feet, 9–26 August, 1937.

None of the three specimens has completed the post-nuptial molt and for this reason wing and tail lengths cannot be measured; the tarsal length is 47.5, 45, 48 mm.

Ictinaëtus malayensis malayensis (Temminck)

1 ♀, 3100 feet, 11 August, 1937.

Compared with a male of *I. m. perniger* from Mt. Angka, Siam, the Bornean bird is much blacker throughout and definitely smaller, wing 550 against 570; if corresponding sexes were to be measured the difference in size would doubtless be even more apparent.

PHASIANIDAE

Arborophila brunneopectus erythrophrys (Sharpe)

2 ad. ♂, 4 ad. ♀, 2 juv. ♂, 1 juv. ♀, 5000–5500 feet, 10 June- 16 July, 1937.

This race was originally described from an adult pair collected on Kina Balu by John Whitehead. When first studying Whitehead's collections, Sharpe thought the specimens represented the young of *A. hyperythra* described by himself from the Lawas River in 1879, but later became convinced that the characters on which *erythrophrys* (*i.e.*, rusty lores, superciliary and sides of face as opposed to the ashy gray color of the corresponding parts of *hyperythra*) was based were not an age character. *A. erythrophrys* was upheld by Ogilvie-Grant in Cat. Bds. Brit. Mus., **22**, 1893, p. 218 but was later synonymized with *hyperythra* by Sharpe himself in his Hand-list, **1**, 1899, p. 29. As far as I can discover this was its fate until reinstated by Chasen, Bull. Raffles Mus., no. 11, 1935, p. 3 in a laconic footnote that reads "*A. erythrophrys* and *A. hyperythra* are distinct forms." I have not seen the latter race, but all the Kina Balu specimens agree with the plate of *erythrophrys* in Ibis, 1890, pl. 4, the rusty parts of the head and face are present in both adults and juvenals. The old females have

more black in the crown than the males, and in one the crown and lores are entirely black. The color of the throat varies independently of age or sex; in one male and one female it is entirely reddish brown; in the other male chiefly so but with a few scattered feathers with black centres, the other three females all have a sprinkling of black centered feathers. The feathering on the throats of the juvenals is rather sparse, but there is enough to show that the chin is whitish and that the black freckling is variable; it is much more extensive and noticeable in the juvenal female than in the two males.

Haematortyx sanguiniceps Sharpe

1 ad. ♂, 1 ad. ♀, 1 imm. ♂, 1 imm. ♀, 1 juv. ♀, 5500 feet, 21 June-8 July, 1937.

The crimson-tipped undertail coverts are fully developed in both the immature birds. The adult male has three spurs on the left tarsus, two on the right. Compared with an adult male from Mt. Dulit, the Kina Balu male is a clear slatey black, not brownish black, but quite possibly the brownish cast to the plumage of the former specimen is due to a post mortem change.

RALLIDAE

Rallina fasciata (Raffles)

1 ♂, 3000 feet, 13 July, 1937.

The single specimen of this rail has the middle of the abdomen white, instead of being regularly barred with black and white like the flanks, as is the case of three old specimens without data, that are available for comparison.

COLUMBIDAE

Treron vernans griseicapilla Schlegel

1 ad. ♂, 1 juv., sea level, 4 and 6 September, 1937.

Two races of this fruit pigeon occur in Borneo, *griseicapilla* in northern and *purpurea* in southern and southeastern. However the boundary between the two races is by no means clearly defined. Mayr (1938 p. 10) refers specimens from Parit, on the Tjempaga River, south Borneo to *purpurea* (type locality, Java) qualifying his identification by the statement that they are somewhat intermediate between

griseicapilla and *purpurea* but nearer the latter. Stresemann records specimens of *T. v. griseicapilla* from the Bahau River in northern Dutch Borneo.

In addition to the birds listed above I have available for comparison with two topotypical Sumatran males of *griseicapilla* the following Bornean specimens:—1 ♂, Baram, 1 ♂, Tawao, 1 ♂, Limbang, 1 ♂, Poelau; the Jesselton bird and the first two listed are surely *griseicapilla;* the two latter are best placed as intermediate between *griseicapilla* and *purpurea* but nearer the former.

Ducula aenea aenea (Linné)

2 ♀, 3100 feet, 18 and 22 August, 1937.

North Bornean examples of *D. aenea* as Chasen and Kloss (1930, p. 13) have already pointed out, differ from *D. a. palawanensis,* the nearest geographic relative, in having the pale head and neck sharply defined from the color of the back and in being smaller. Four Palawan specimens have a wing measurement of 236, 239, 243, 247; North Bornean skins run 225, 228, 229, 235; other Bornean measurements, including 3 from the interior measured by me, 5 ♂ and 2 ♂ from southern Borneo by Mayr and a north Bornean ♀ by Chasen and Kloss run from 230–241; Stresemann's single ♀ from Badang is the largest with a wing of 244.

Ducula badia badia Raffles

3 ♂, 3100 feet, 15–25, August; 1 ♂, 2 ♀, 1 not sexed, 5500 feet, 11 June-31, July; 1 ♂, 7000 feet, 21 July, 1937.

A male and female of topotypical *badia* from Sumatra have wings 231 and 218 mm. respectively, while the Kina Balu series measures, males, wing 220, 227, 232, 233; females 221, 233, 234. Both Sumatran birds, the male especially, have the crown much clearer gray, less washed with vinaceous than the Kina Balu series.

Macropygia ruficeps nana Stresemann

5 ♂, 1 ♀, 3100 feet, 27 July-25 August; 1 ♀, 4790 feet, 7 July; 2 ♂, 1 ♀, 5500 feet, 21 June-30 July, 1937.

This nice series is virtually topotypical; the type came from an elevation of 3000 feet on Mt. Kina Balu.

CUCULIDAE

Cuculus sparverioides bocki (Wardlaw Ramsay)

2 ♂, 3100 feet, 27 July and 18 August; 1 ♂, 4500 feet, 6 June, 1937.

Wings 172, 178, 185.5; tails 164, 168, 177.

Cuculus fugax fugax Horsfield

2 ♂, 3100 feet, 11 August, 1937.

Wings 168, 170.

Cuculus poliocephalus insulindae (Hartert)

1 ♀, 4700 feet, 6 June; 1 ♂, 1 ♀, 5500 feet, 12 June and 21 July, 1937.

Topotypes of the subspecies, originally named from Kina Balu.

Cacomantis merulinus threnodes Cabanis & Heine

2 ♂, 3100 feet, 26 August, 1937.

Chalcites malayanus malayanus (Raffles)

1 ♂, 3100 feet, 26 August, 1937.

This is apparently an immature bird; the underparts are plain grayish white, bars are apparent on the posterior flank feathers and a single barred feather has made its appearance on the breast. A male collected by H. G. Deignan at Abai, Borneo, 28 July, 1937 is in a more advanced stage of this same plumage, numerous barred feathers having made their appearance on the underparts, but the completely barred under surface of the adult plumage is not yet fully developed.

STRIGIDAE

Otus spilocephalus luciae (Sharpe)

1 ♂, 2 ♀, 6000 feet, 5–8 July, 1937.

This form was originally described from specimens collected on Kina Balu by Whitehead during his second expedition. He found it only "in the dark and gloomy forests which occur in large patches at about 9000 feet."

The bird is now known to occur on other mountains in Borneo and is probably not as restricted in its altitudinal range as first supposed. The Museum of Comparative Zoölogy possesses a skin from Mt. Dulit collected at an elevation of only 3400 feet.

APODIDAE

Collocalia vestita maratua Riley

1 ♂, 1 ♀, 3100 feet, 8 and 9 August, 1937.
♂, wing 116.3; ♀, wing 115.1

Collocalia esculenta dodgei Richmond

1 ♂, 1 ♀, 4900 feet, 3 July, 1937.

This small montane form was originally described from Mt. Kina Balu; according to Chasen it occurs on other mountains in northern Borneo and on Korinchi Peak, Sumatra.

The measurements of the two specimens before me are ♂, wing 91.5, tail 35; ♀, wing 90.5, tail 31.5 mm.

A female of *C. e. cyanoptila* from Sandakan has a wing of 99.3 and tail 36.6; it is also a much glossier bird.

CAPITONIDAE

Chotorhea chrysopogon chrysopsis (Goffin)

1 ♂, 1 ♀, 3100 feet, 12 and 21 August, 1937.

These birds are identical with birds from the Bornean lowlands from the region about Sandakan.

Cyanops monticola Sharpe

3 ♂, 3100 feet, 23 and 24 August; 2, not sexed, 3500 feet, 27 June; 1 ♂, 1 ♀, 4750 and 4900 feet, 7 June and 3 July; 1 ♂, 5500 feet, 18 July, 1937.

I cannot agree to the inclusion of *monticola* in the *oorti* Formenkreis; the latter association should of course include *nuchalis* and *annamensis* and probably *incognita* and *faber*, but according to my conceptions *monticola* is definitely out; of course it does not belong in Chotorhea where Sharpe placed it in his Hand-list, it seems to fit better in Cyanops.

It is a species of an arrested or retrograded type of color and pattern, the throat is never golden yellow, the definite black markings on the sides of head are entirely lacking, there is no red spot on the lores or across the forehead; in addition the bill is relatively much larger.

Cyanops armillaris pulcherrima (Sharpe)

1 ♂, 3100 feet, 23 August; 4 ♂, 8 ♀, 5500 feet, 10 June-26 July; 3 ♂, 7000 feet, 18– 31 July, 1937.

This form is no doubt correctly placed as a montane representative of the Javan *armillaris* which is also replaced in the Bornean lowlands by *C. a. brachyrhyncha* Neumann, the latter occupying a more or less intermediate position between the two extremes. In addition to the large series collected by Mr. Griswold I have examined another Kina Balu specimen taken by Everett's native collectors and a ♂ and ♀ from Mt. Tibang, Dutch Borneo collected by E. Mjöberg. None of the specimens examined show the slightest approach to *C. a. brachyrhyncha.*

Cyanops eximia cyanea (Harrisson and Hartley)

Mesobucco duvaucelii cyaneus Harrisson and Hartley, Bull. Brit. Orn. Cl., **54**, 1934, p. 151 (Mt. Kina Balu.)
1 ♀, 3500 feet, 27 June, 1937.

This form was very briefly characterized in the original description as having "frontal band blue, not black or blue-black." As poor a description as can be imagined!

Chasen regards both *eximia* and *cyanea* as races of *C. australis* which is represented in the Bornean lowland by *C. a. duvaucelii.* Mayr believes that *eximia,* (type locality, Mt. Dulit), a montane form, should be accorded specific rank in which I concur. The comparative differences between *C. a. duvaucelii, C. e. eximia,* and *C. e. cyanea* are shown in the following table:

Throat blue	*cyanea*
	duvaucelii
Throat black	*eximia*
Ear coverts blue	*cyanea*
	eximia
Ear coverts black	*duvaucelii*
Forehead blue	*cyanea*

Forehead black	*duvaucelii*
	eximia
Subocular spot red	*duvaucelii*
Subocular spot yellow	*cyanea*
	eximia
With red on crown	*cyanea*
With red on occiput	*eximia*
No red on head	*duvaucelii*

It might be well to mention that in *C. australis*, the longest facial bristles extend well beyond the tip of the bill while in the specimens of *cyanea* examined they barely reach the tip, the same condition is found in *eximia* if the plate in the Ibis, 1892 is accurate.

PICIDAE

Callolophus miniaceus dayak Stresemann

1 ♀, 3100 feet, 16 August, 1937.

According to Chasen it is *C. m. miniaceus* that occurs on the lower slopes of Kina Balu, but this specimen with a wing of only 112 mm. is clearly identifiable as the small *dayak;* in the typical race the wings range from a minimum of 120 for females to a maximum of 134 for males.

Chrysophlegma mentale humii Hargitt

1 ♂, 1 imm. ♂, 5500 feet, 16 and 29 June, 1937.

In size these birds are about the minimum for *humii* and thus approach the smaller *saba* of southern and eastern Borneo; the ad. ♂ has a wing of 125, the immature one of 124 mm. The presence of a slight admixture of chestnut in the feathers of the malar stripe of the adult throws the scales in favor of *humii*.

EURYLAIMIDAE

Calyptomena whiteheadi Sharpe

3 ad. ♂, 1 imm. ♀, 5000–5500 feet, 24 July– 3 August, 1937.

I can detect no differences between this topotypical series and a pair collected by Mjöberg at about 4000 feet on the upper Kajan River near Mt. Tibang.

Psarisomus dalhousiae borneensis Hartert

1 ad. ♂, 1 imm. ♂, 1 ♀, 3100 feet, 23 and 24 August; 3 ♂, 1 imm. ♀, 5500 feet, 18 June– 28 July, 1937.

The Bornean race of this bird is very close to *psittacinus,* the form inhabiting the Malay States and Sumatra, but is of a yellower green, the difference is not too apparent unless *psittacinus* and *borneensis* are compared in series.

Eurylaimus ochromalus kalamatan Robinson and Kloss

2 ♂, 2 ♀, 30 August, 1937.

Mayr reduces *kalamatan* to a synonym of *ochromalus* on the grounds that the overlap in wing measurements is more than 50%. I am not willing to accept this disposal offhand. Robinson and Kloss type series came from the Saribas district of Sarawak (altitude not given), the males have a wing of 82–89, the females one of 81–84; in 1930 Chasen and Kloss gave the wing measurements of 10 ♂ from the north Bornean lowlands running from 77–85, and of 5 ♀ from 75–79, remarking that the north Bornean series was less distinct from the Malay Peninsula population than the Sarawak birds. My two Kina Balu males have wings 82.5 and 83, the females 79 and 80. A ♂ from 4000 feet on the upper Kajan River has a wing of 82.5 and three females from the same locality, 80, 83 and 84. On the other hand two males from about Sandakan have wings only 74–78 and three females 73.5–77.5, thus rather closely approximating five males of *o. ochromalus* (Malay trade skins) whose wings measure 75, 75.5, 76, 77.5, 78 and three females (Malay trade skins) 71.5, 76, 77. While the absence of any reference to the altitude of the Saribas type series and the omission of the altitude from the labels of much of the material available to me prevents positive conclusions, evidence points to *kalamatan* being a recognizable race of the mountains of Borneo, with *ochromalus* occupying the lowlands. Stresemann refers the birds collected by von Plessen on the Kajan River to *kalamatan* without comment. Unfortunately the measurements he gives are not segregated by locality.

CORVIDAE

Cissa jefferyi Sharpe

1 ♂, 1 ♀, 7000 feet, 24 and 25 July, 1937.

Chasen regards this bird as a race of *chinensis* replacing *minor* at the higher elevations. In my opinion it is more nearly allied to *thalas-*

sina of Java (which Chasen also believes to be conspecific with *chinensis*). My own feeling in the matter is that both *thalassina* and *jefferyi* should be kept as distinct species, a treatment that was accorded them by Delacour in his review of the genus (Ois., **10**, 1929, p. 2–12.)

Dendrocitta occipitalis cinerascens Sharpe

3 ♂, 3 ♀, 3100 feet, 20–24 August; 2 ♂, 1 ♀, 4800 feet, 6 and 7 June; 2 ♀, 5000 feet, 8 and 18 July; 1 ♂, 1 ♀, 7000 feet, 9 and 13 July, 1937.

So many of this series are in moult that satisfactory wing and tail measurements are not possible. The range of variation in the color of the upper parts indicate that Chasen's objection to the recognition of *D. o. tuckeri* Harrisson and Hartley, is well founded.

MUSCICAPIDAE

Muscicapula melanoleuca westermanni Sharpe

1 juv. ♂, 3100 feet, 11 August, 1937.

A juvenile, still in spotted plumage, is without doubt referable to this form; no adults accompany it.

Dendrobiastes hyperythra malayana (Ogilvie-Grant)

5 ♂, 3 ♀, 7 juvs., 5500 feet, 12 June– 3 August; 1 ♂, 11,000 feet, 12 August, 1937.

These birds, with brown (instead of blue-gray) backed females, must surely be referred to *malayana,* not to *mjöbergi.*

PYCNONOTIDAE

Chloropsis cochinchinensis flavocincta Sharpe

1 ♂, 2 ♀, 3100 feet, 21–23 August; 1 ♂, 3500 feet, 7 June, 1937.

I have doubts as to whether this bird is correctly placed as a race of *C. cochinchinensis.* Though the male of this form bears a close resemblance to the males of the *cochinchinensis* Formenkreis, the female is quite different in the possession of a black throat. Thus we have a species with a black throated male and a female with a blue-green throat found in India and Ceylon (*jerdoni*); the greater part of south-

eastern Asia (*cochinchinensis*); Malay States, Sumatra, Natuna Islands (*icterocephala*); Java (*nigricollis*) and parts of Borneo (*viridinucha*). Then suddenly we find that the female of the bird of the mountains of Borneo has a black throat; this to my mind indicates that the nearest relationships of *flavocincta* are with *media* of the Sumatran highlands in which both sexes have a black throat.

Criniger ruficrissus Sharpe

6 ♂, 6 ♀, 3100 feet, 11–24 August; 1 ♂, 5500 feet, 12 July, 1937.

Mayr has recently stated that *ruficrissus* is a distinct species, not a race of *gutturalis*. He does not say on what grounds he bases this statement; certainly there is a strong superficial resemblance between the two forms, but there can be little doubt that Mayr is right and that the much larger and relatively longer tailed *ruficrissus* deserves specific rank.

TIMALIIDAE

Rhinocichla mitrata treacheri (Sharpe)

14 ♂, 7 ♀, 3100 feet, 7–26 August; 1 ♂, 1 ♀, 1 juv. ♀, 1 not sexed, 4750 feet, 6 and 7 June; 10 ♂, 5 ♀, 5500 feet, 9 June– 1 August; 1 ♂, 7000 feet, 18 July, 1937.

Harrisson and Hartley have named (Bull. Brit. Orn. Cl., **54**, 1934, p. 154) *R. m. damnata* from Mt. Dulit; not all the characters enumerated in the original description hold good, but the absence of pale shaft lines to the breast and throat feathers of *damnata* (4 examined) and their presence in every skin of *treacheri* from Kina Balu (46 examined) serve to distinguish the two races at a glance. Messrs. Harrisson and Hartley believe that a least one additional race may be separated, and this supposition is fully borne out by a series of seven specimens from the interior of Dutch Borneo (Kajan River and Mt. Tibang). This form may be called

Rhinocichla mitrata griswoldi subsp. nov.

Type.—M. C. Z. no. 236020, adult not sexed (= ♂ by measurement), Mt. Tibang, 4000 feet, collected 19 November, 1923, by Eric Mjöberg.

Characters, similar to *R. m. damnata* Harr. and Hartl. in lacking prominent pale shaft lines to the feathers of throat and breast, but

anterior under-parts much richer, Cinnamon Buff[1] to Clay Color instead of Cinnamon Buff to Dark Olive Buff.

Measurements:

treacheri	10 ♂	wing 99–109;	10 ♀	96–104.5
damnata	3 ♂	96–106;	1 ♀	103
griswoldi	5 ♂	98–109;	2 ♀	95.5–100

Pomatorhinus montanus bornensis Cabanis

1 ♂, 3100 feet, 18 August; 1 ♂, 5500 feet, 19 June, 1937.

Wings 83 and 79.5 respectively. Not different from two specimens from the upper Kajan River.

Napothera brevicaudata crassa (Sharpe)

1 ♂, 3100 feet, 19 August; 1 ♀, 4900 feet, 3 July; 4 ♂, 7 ♀, 5500 feet, 11 June–27 July; 2 ♂, 1 ♀, 7000 feet, 6 and 28 July, 1937.

This bird is of course a geographic representative of *Napothera brevicaudata* several forms of which occur in the mountains of southeastern Asia. Another form of *Napothera, N. epilepidota exsul* (Sharpe) occurs on Kina Balu, but was not secured by Mr. Griswold. The generic name *Napothera* was originally introduced by Boie in 1832 and subsequently used as *Nopothera* and *Napothera* by S. Müller in 1835 but was a nomen nudum in each case; its first valid proposal was by G. R. Gray in 1842.

Staphidia castaniceps everetti Sharpe

6 ♂, 3 ♀, 3100 feet, 6–24 August; 1 ♂ 4400 feet, 6 June; 3 ♂, 2 ♀, 5500 feet, 29 June– 3 July, 1937.

In addition to the series of topotypes listed here, I have examined specimens of this bird from Long Navang and Mt. Penrissan, Dutch Borneo, Mt. Poi, 5000 feet, Sarawak, and Gunong Kanepai. While there is some variation in the color of the upper parts and especially in that of the top of the head, in the skins examined from the different localities, more material is required to determine how much of it is geographical and how much is due to wear, season or post mortem change. There appears to be no size difference.

[1]Ridgway, Color Standards and Color Nomenclature, 1912, pl. 29 and 40.

Pteruthius flaviscapis robinsoni Chasen and Kloss

4 ♂, 4 ♀, 5500 feet, 9 June– 12 July; 1 ♂, 7000 feet, 16 July, 1937.

There is no question but that this race if quite distinct from *P. f. aerulatus* with which it was principally compared, but it is very close to *cameranoi*, differing chiefly in slightly larger size.

Measurements:	♂ *W.*	*B.*	♀ *W.*	*B.*
aerulatus	78	15.1	77.	13.5
	76	14.2	76.5	13.7
			77.5	13.5
			76	13.7
cameranoi	69.5	12.9	71.5	12.3
robinsoni	72.5	12.7	73	12.5
	74	12.7	73.5	12.1
	76	13.4	74.5	12.5
	74	12.4	72.5	12.5
	74	11.1		

TURDIDAE

Copsychus saularis niger Wardlaw Ramsay

1 ♂, 1 ♀, 3100 feet, 29 July and 18 August, 1937.

Both these birds are certainly referable to *niger*, the underparts of the male are entirely glossy black, with a small amount of white in the under tail-coverts; both outer pairs of rectrices are entirely white and some of the inner secondaries white-edged; the female has the under tail-coverts mostly white; the two outer pairs of rectrices entirely and the next pair mostly, white; the white on the inner secondaries is greater in extent.

Brachypteryx montana erythrogyna Sharpe

8 ad. ♂, 6 ad. ♀, 2 imm., 5500 feet, 9 June–25 July; 2 ad. ♀, 2 imm., 7000 feet, 6–28 July; 1 ♂, 9790 feet, 29 July, 1937.

Both Myiophonus and Brachypteryx have been placed in the Turdidae by most recent authorities. Removing these genera from the Timeliidae to the Thrushes, even though the plumage of the juvenals is not characteristically thrush-like, is almost certainly the proper procedure. Anything that can be done to distribute the genera of the

so-called Timeliidae among the better characterized and more natural groups is a step in the right direction.

LANIIDAE

Hyloterpe hypoxantha hypoxantha Sharpe

1 ♂, 4 ♀, 3100 feet, 19–23 August; 1 ♀, 3500 feet, 27 June; 2 ♂, 3 ♀, 5500 feet, 10 June–31 July; 1 ♂, 1 ♀, 7000 feet, 16–30 July, 1937.

This series is exactly topotypical; three specimens from Mt. Tibang agree with it and are not like *H. h. sarawacensis* Chasen which is said to have the underparts more uniformly yellow.

The Tibang birds have wings 81.5, 84.5, 84.5; Kina Balu birds,—80, 82, 82.5, 83, 83.5, 84, 84, 85, 87 mm.

SYLVIIDAE

Seicercus trivirgatus kinabaluensis (Sharpe)

2 ♂, 1 ♀, 5500 feet, 16–30 June, 1937.

These birds appear to be of the normal type of coloration for the form.

Seicercus montis montis (Sharpe)

2 ♂, 25 and 27 June, 1937.

This species looks to be out of place in Seicercus, but is retained here for want of a better position.

Horeites montana oreophila (Sharpe)

1 ♀, 5500 feet, 30 June; 2 ♂, 11,000 feet, 15 August, 1937.

Chasen places the *montana* Formenkreis in Cettia, but that genus is characterized by very weak and poorly developed rictal bristles while those of Horeites are prominent. A general revision of the Sylviidae will doubtless result in a very different arrangement from that in use at present.

ZOSTEROPIDAE

Zosterops atricapilla clara Sharpe

1 ♂ juv., 3100 feet, 13 August; 1 ♂, 4750 feet, 7 June; 1 ♂, 5500 feet, 11 June, 1937.

Chasen synonymizes *clara* with typical *atricapilla* from the highlands of Sumatra; Stresemann in his review of the Zosteropidae maintains it.

Chlorocharis emiliae emiliae Sharpe

2 ♂, 1 ♀, 5500 feet, 16 June–6 July; 1 ♂, 7000 feet, 5 July; 5 ♂, 3 ♀, 9800–11,000 feet, 29 July–14 August; 2 ♂, 1 ♀, 12,000 feet, 9–11 August, 1937.

This series is topotypical of *emiliae;* in the mountains of Sarawak it is replaced by *C. e. moultoni* Chasen and Kloss.

NECTARINIIDAE

Aethopyga mystacalis temmincki (S. Müller)

2 ♂, 3100 feet, 19 and 25 August, 1937.

Not different from two males from Sumatra as far as I can see. Chasen has given his reasons for not recognizing *A. m. perretti* Harrisson and Hartley, from Mt. Dulit.

Cinnyris jugularis microleuca Oberholser

3 ♂, 1 ♀, sea level, 4–6 September; 1 ♀, 3500 feet, 7 June, 1937.

I have insufficient topotypical material of the various named forms of this species to attempt to work out their characters and distribution, but rely on Chasen's arrangement whereby the birds inhabiting the Malay Peninsula, Sumatra, Borneo and the Natuna Islands are all referred to this race, the type locality of which is Taya Island, southeastern Sumatra.

Anthreptes malacensis bornensis Riley

2 ♂, 1 ♀, sea level, 4 and 6 September; 1 ♂, 1 juv. ♀, 3100 feet, 26 August, 1937.

The identification of this small series is made largely on the grounds of probability; *bornensis* is a pretty thin form, and the fact that the males have not quite completed their post nuptial moult makes identification uncertain.

Arachnothera everetti (Sharpe)

1 ♂, 3100 feet, 14 August, 1937.

Originally described from Mt. Kina Balu, the measurements given were wing 3.6″, culm. 1.7″ roughly equivalent to 95 and 45 mm.

respectively. Griswold's bird measures wing 95.5, culm. 40; a bird from Long Navang, Dutch Borneo taken by E. Mjöberg measures wing 90, culm. 39. Four skins from the lowlands of North Borneo (Morutai Besar and Sandakan) taken by H. Deignan have wings of 88 mm. and culmens 35, 36, 36.8, 38.2. Stresemann records a male with a wing of 87 mm. from Peleben near the junction of the Kajan and the Bahau.

PLOCEIDAE

Lonchura atricapilla jagori Martens

1 ♂, 1 imm.? sea level, 4 September; 2 ♂, 3100 feet, 20 and 24 August; 1 ♀, 5500 feet, 10 July, 1937.

Bornean and Philippine examples of this species do not appear to be separable. Chasen and Kloss correctly refer to this form as *jagori*, but Mayr has recently called it *minuta*. The latter name is the older, but happens to be preoccupied.

In addition to the forms discussed in the body of this paper, Mr. Griswold collected the following species on Mt. Kina Balu, the list of which is appended for the sake of completeness.

Chalcophaps indica indica (Linné)
Centropus bengalensis javanensis (Dumont)
Cypsiurus balasiensis infumatus (P. L. Sclater)
Buceros rhinoceros borneoensis Schlegel and Müller
Rhyticeros plicatus subruficollis (Blyth)
Harpactes whiteheadi Sharpe
Harpactes oreskios dulitensis Ogilvie-Grant
Pericrocotus flammeus xanthogaster (Raffles)
Pericrocotus montanus cinereigula Sharpe
Chlamydochera jefferyi Sharpe
Hemipus picatus picatus (Sykes)
Cissa chinensis minor Cabanis
Rhipidura albicollis albicollis (Vieillot)
Rhinomyias umbratilis umbratilis (Strickland)
Rhinomyias gularis Sharpe
Culicicapa ceylonensis ceylonensis (Swainson)
Stoporala indigo cerviniventris (Sharpe)
Stoporala thalassina thalassoides (Cabanis)
Microtarsus melanoleucus Eyton
Ixos flavala connectens (Sharpe)

Trachycomus zeylonicus (Gmelin)
Pycnonotus goiavier gourdinii (Jacquinot and Pucheran)
Pycnonotus (*Oreoctistes*) *leucops* (Sharpe)
Pycnonotus (*Otocompsa*) *flaviventris montis* (Sharpe)
Garrulax palliatus schistochlamys Sharpe
Androphilus accentor Sharpe
Aethostoma pyrrhogenys canicapillum (Sharpe)
Stachyris nigriceps borneensis Sharpe
Enicurus leschenaulti borneensis Sharpe
Myiophonus borneensis P. L. Sclater
Turdus javanicus seebohmi (Sharpe)
Geokichla everetti Sharpe
Artamus leucoryn. leucoryn. (Linné)
Tesia whiteheadi (Sharpe)
Prinia flaviventris superciliaris Salvadori
Orthotomus sepium borneonensis Salvadori
Dicaeum sanguinolentum monticolum Sharpe
Dicaeum trigonostigmum dayakanum Chasen and Kloss
Dicaeum concolor borneanum Lönnberg
Arachnothera longirostra büttikoferi van Oort
Lonchura fuscans (Cassin)
Oriolus cruentus vulneratus Sharpe
Dicrurus leucophaeus stigmatops (Sharpe)
Dicrurus hottentottus borneensis (Sharpe)

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THE BUTTERFLIES OF THE SATYRID GENUS COENONYMPHA

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Portland, Oregon

With Ten Plates

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No. 4—*The Butterflies of the Satyrid Genus Coenonympha*

By Demorest Davenport

CONTENTS

INTRODUCTION

While collecting Lepidoptera in the summers of 1933–34 in Colorado I became interested in the Satyridae. As is well known, the species of this family of butterflies are often extremely variable, particularly in regions with great range of altitude.

After a survey of the Nearctic members of the genus *Coenonympha* had been made with the intention of straightening out our native forms, I saw that the genus offered a most interesting subject for study, with problems of variation, of limitation to characteristic habitat, of lines of dispersal, etc. Why are certain forms limited to small areas and others widespread? What has been done and what remains to be done with the biology of species? What effect has change in the environment on the coloration of forms?

However, I soon realized that little could be done with these interesting general problems until an extensive taxonomic study of the species of the world had been made to lay the foundation for later work.

Further consideration, plus evidence that the rearing of some forms at least was not difficult, convinced me that such a study might instil some entomologists with the desire to pursue the developmental and ecological problems. It would be of value to work out the life-histories of certain forms in controlled environments of differing temperature, moisture-content, and light, to see just how subject to change are their characteristic colors. In the genus are species differing considerably in their reaction to the change of season. Good examples of this are *tullia* (=*tiphon*) and *pamphilus*, the former, with the exception of the Nearctic *california*, being rather fixed, and the latter, as we shall see later, extremely variable. Work on the biology of both under controlled environment would be of value. What could be done with the populations of the *arcania—gardetta* series, which all Continental entomologists know present such a perplexing taxonomic and biological problem? Or, for those fortunate enough to work in far places, with such a variable and interesting species as *semenovi* of Szechuan and Kansu? Certainly there are no better subjects for evolutionary study than such variable species as these.

It will be said that the rearing of such Satyrids is a long, tedious, and thankless job, and that the raising of a large number of individuals through their life-history in controlled environments would be extremely difficult. Given the facilities, however, and the time and energy to start by collecting large numbers of eggs from confined females, species such as *pamphilus* could, it is felt, be raised in sufficient numbers to produce very interesting results. And in Europe this species is very widespread and common. If only the energy were devoted to this type of work that is spent on publishing lists of the fauna of certain micro-regions!

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Above all I am indebted to Professor Charles T. Brues, whose kind advice and continued help has enabled me to finish this paper. Others at Harvard to whom I am grateful are Nathan Banks and Frank M. Carpenter.

For their hospitality and kindness in putting the collections under their care at my disposal I thank Dr. André Avinoff, Director of the Carnegie Museum of Pittsburgh, Dr. J. McDunnough of the Entomological Branch of the Department of Agriculture at Ottawa, Drs. E. A. Chapin and Austin H. Clark of the United States National Museum, Mr. E. T. Cresson, Jr. of the Philadelphia Academy of Natural Sciences, Mr. F. E. Watson of the American Museum of

Natural History, and Professor W. T. M. Forbes of Cornell University.

Others in America who have materially aided me with advice, specimens and notes are Messrs. L. E. Chadwick of Washington, D. C., F. M. Brown of Colorado Springs, Cyril F. dosPassos of Mendham, New Jersey, Capt. R. C. Williams, Jr. of New York City, and Ralph and Frank Chermock of Pittsburgh, Pa.

In the summer of 1936 I received a grant from the Bache Fund of the National Academy of Sciences, which enabled me to make the survey of Old World forms and to see great series of specimens collected from all parts of Europe, Asia and North Africa. In turn I visited London, Tring, Berlin, Dresden, Munich and Vienna.

I am very greatly indebted to Mr. N. D. Riley, Keeper of Entomology at the British Museum of Natural History in South Kensington, and wish to thank him and his staff for their aid and great hospitality. Captain Francis Hemming of London was extremely kind in putting at my disposal his private collection and his carefully compiled bibliography on palaearctic butterflies, which was of untold aid in working out the synonymies of the species. I also acknowledge the hospitality of the late Lord Rothschild during my short visit to the Zoological Museum at Tring. Mr. B. C. S. Warren of Folkestone, whose "Monograph of the genus Erebia," (1936) a related genus, is a model for all working with the taxonomy of Lepidoptera, was also very kind.

I wish to express my thanks to Dr. Martin Hering and Herr Bryk of the Museum für Naturkunde in Berlin, to Herr O. Bang-Haas, Herr Walter Rentsch, and Herr Friederich Scheidemann of the firm of Staudinger-Bang-Haas at Dresden-Blasewitz and to Herr Johannes Draeseke and Dr. Claus Gunther of the Museum für Tierkunde in Dresden, to Dr. Kurt von Rosen of the Zoologische Anstalt in Munich, and to Dr. Franz Maidl, who in the absence of both Professor Rebel and Dr. Zerny, put at my disposal the collections of the Naturhistorisches Museum in Vienna. Since my visit there I have become indebted to Dr. Zerny for the loan of specimens and his many helpful communications.

Unfortunately I was unable to visit the extensive collections at the Academy of Sciences of the USSR in Leningrad. However, Dr. N. J. Kusnezov very kindly sent me records taken from the collections under his care, from the literary sources and from his yet unpublished MSS on the Arctic Fauna of Eurasia, to the publication of which we may look forward.

I am greatly indebted to Herr Leo Sheljuzhko of Kiev for specimens and much information concerning the distribution of several species in eastern Russia, the Caucasus and Transcaucasia.

I also wish to thank Dr. L. R. Natvig of the Universitetets Zoologiske Museum in Oslo and Herr F. Nordström of Stockholm for specimens and information on the distribution of species in Scandinavia.

MATERIAL

My first study of the numerous species as well as the investigation of their morphology, was made with the collection of the Museum of Comparative Zoology at Harvard University, which includes the collection of the late A. G. Weeks, that contains specimens of nearly all described forms. At Pittsburgh I was able to see, besides the general collection, the many specimens assembled by Dr. Holland; at Philadelphia notably the collection of Dr. Henry Skinner and series assembled by Capt. Williams, including specimens collected by O. Querci which supplement those of the Weeks collection; at Washington the great collection of William Barnes. I was also fortunate in being able to study the collections of the American Museum of Natural History, of the Entomological Branch of the Department of Agriculture at Ottawa, and of Cornell University, which includes the collection of Professor Forbes.

At the British Museum of Natural History of greatest importance were the collections of H. J. Elwes, containing specimens acquired by him from Russia and the Far East from both Alphéraky and Grum-Grzhimailo, and that of Charles Oberthür, with its long series and many types from Europe, Asia, and North Africa. Other series, some of which were incorporated in the general collection of the Museum, were those of Leech, Hewitson, Godman and Salvin, Frey, Joicey, Evans and Graves. The greatest part of my work on the Palaearctic species is based on the great assemblage of specimens in this institution; subsequent work was, of course, necessary and interesting but in large part supplementary.

At Tring was the collection of Lord Rothschild, particularly rich in its series from North Africa; at Berlin the Püngeler, Kindemann, and Thurau collections; at Dresden-Blasewitz the great Staudinger collection with its many types, next in size and importance to the Oberthür collection in London, and the collection of Herr Bang-Haas; at the Museum für Tierkunde in the Zwinger in Dresden the Calberla, Stötzener, Seiler and Gruner collections; at Munich the Dannehl and

Martin collections as well as specimens collected by Dr. von Rosen. Finally at Vienna I was fortunate in seeing the collections of Professor Rebel and Dr. Zerny, particularly rich in eastern European material.

Among both palaearctic and nearctic workers there is at times a surprising lack of knowledge and interest in the fauna of the opposite land-mass. It is to be regretted that so large a group of capable workers are not more interested in the interrelationships of the two regions, and undoubtedly a great deal of important zoogeographical data is lost sight of for this reason. In many groups we must recognize that there is no distinction between the eastern part of the Palaearctic and Nearctic. It will be seen that I have purposely neglected to separate the *Coenonympha* of the New World from those of the Old; it must be admitted that in a study of nearly any Holarctic group of organisms, a knowledge of the fauna of both parts of the region, which are separated in a large part because of the manner of the growth of the science, is indispensable. Let us hope for a greater exchange of knowledge in the future.

CATEGORIES

In this work I have used exclusively a trinomial system of nomenclature. This necessitates the abandonment of a number of names. It is a natural tendency for one confronted with a jumble of aberrational, undefined form-names, and varietal names based on minute quantitative differences in color, mistakenly to "lump" together some good subspecies. Again, through lack of information on the biology of the insect he may make subspecies or even species out of seasonal forms. I have, however, tried to steer the middle path, to avoid the retention of useless names and to retain useful ones.

THE SPECIES

I have endeavored to follow the concepts of E. B. Poulton, (1903, pp. lxxvii-cxvi) who makes "continuity and transition in characters the test of a variety, discontinuity the test of a separate species." He also says: "The conception of species is founded upon transition. Whenever a set of individuals can be arranged, according to the characters fixed upon by the systematist, in a series without marked breaks, that set is regarded as a species. The two ends of the series may differ immensely, may diverge far more widely than the series itself does from other series; but the gradual transition proclaims it a single species. If transitions were all equally perfect of course there would be

no difficulty. But transitions are infinite in their variety; while the subjective element is obviously dominant in the selection of gaps just wide enough to constitute interspecific breaks, just narrow enough to fuse the species separated by some other writer—dominant also in the choice of the specific characters themselves."

Of course the immediate criticism of the application of such a criterion in the case of a genus as uniform morphologically as *Coenonympha* is that the subjective element is far too dominant. This must be admitted, but there is no way of avoiding it. I have separated species on the above basis in conformity with what I feel best shows the relationships in nature of the animals concerned.

THE SUBSPECIES

I have used the word subspecies because it simply designates, when undefined, the category below the species. I do this because I feel that it is the term most commonly used by biologists. We must admit that any term is quite satisfactory, provided it is accurately defined. It is felt, however, that the invention of new terms for categories is quite pointless, when a certain number are in common usage. After all, we are aiming at stabilization in our science of taxonomy.

After searching for a satisfactory definition of the subspecies as I see it in nature in this genus, I was unable to find a more fitting one than that of Marston Bates (1935, pp. 70–71) of the "choromorph." In applying this definition to the subspecies of *Coenonympha* the subjective element again enters strongly when it is considered that for the most part the only differing heritable morphological characteristics are color and pattern ones. However, I have called subspecies only those populations that are distinguished from other similar ones by color characteristics which I believe to be constant. It must be admitted that this genetic constancy can only be proved by breeding. Though size and color are the only characteristics in which subspecies and even many species seem to be distinct in the genus, it is believed that these alone are enough to warrant the separation of the forms as they stand in this paper.

Continuing, Bates says: "The category here defined as a choromorph obviously differs not at all from the subspecies of most mammologists, ornithologists and lepidopterists . . . "

He attempts to justify his change of term by saying: "The significance of the subspecies is due to the widely accepted theory that geographical isolation is necessary for the formation of new species, and

if the term is to have any meaning, it must be restricted to this usage for geographical varieties." But his term, choromorph, by definition, must be restricted to the same usage. After urging that the word subspecies be retained for geographical varieties, he creates a new term for the same concept. His definition of choromorph agrees, as he himself says, with the concept of subspecies of most taxonomists. Furthermore, I see nothing in the concept that implies that new species can be formed *only* through *geographical* isolation. This seems contrary to the mutation theory. We must admit that isolation is often more apparent than real. At any rate, would it not be wiser to retain the much used term, subspecies, and only create new terms for variations "of equal evolutionary significance" to the geographic ones which cannot be included as geographical varieties, (subspecies) and the cause of which we definitely know.

It is felt that Bates has most expertly discussed the problem of categories in the Lepidoptera, but that he has added nothing by his change of term. Certain of his concepts apply far better to the isolated insular faunae about which he is writing than they do to continental faunae. He says: "It should be remembered that by definition two 'choromorphs' (subspecies) of the same species cannot exist at the same place at the same time." Aside from the fact that this concept is *not* truly implied in his definition, I cannot agree with it. In continental faunae there may be two populations which are at the opposite ends of a complete or broken circle of distribution dispersed originally from a common ancestral form still in existence. These will differ very greatly and may, if they overlap, be prevented from fusing by a "physiological barrier" or an inherent physiological difference that has continually been increasing since their split from the common ancestor. If these ends of the circular chain of populations approach and overlap, in a certain zone we will have two forms flying in the same place at the same time and not mixing. These forms, because of the connecting chain between them, by definition must be considered subspecies of the same species. That this situation may exist in island faunae, where, however, the geographical areas occupied by the populations are distinctly isolated from each other by water and therefore the chain seems more broken, Bates (p. 77) admits:

"One of the most interesting cases of this sort is furnished by the American forms of *Precis*. Cuba is inhabited by two forms that are apparently quite independent—'good species'. The one form is like that found in the United States (*P. coenia*); the other is found in Cuba, Hispaniola, Jamaica and northern South America (*P. zonalis*). The

two are apparently connected by intermediate forms in Central America. The material available has proved inadequate for a thorough study of this group, as the range of individual and seasonal variation is large, but it is difficult to avoid the inference that extreme forms have become differentiated on the continent and have reached Cuba from the north and from the south, sufficiently distinct to retain their identity there as separate populations."

Yet Bates cannot refrain from considering the two Cuban insects distinct species because of a concept which is not included in his subspecific definition anyway, when all the evidence points to the fact that they are connected by a chain of populations.

However, if the areas of distribution of two end populations do overlap and if the insects had become sufficiently differentiated from each other to be prevented from fusing by a physiological barrier, they would probably occupy habitats of different types and not often be thrown together. Their areal distribution may be the same as far as can be told from the labels on museum specimens or the meagre gleanings from collectors' notes, but there is not true overlap because of the occupation of different habitats.

Incidentally it must be kept in mind that two forms that fly together in the same actual habitat at the same time may be forms of a di- or polymorphic species. We may have Mendelian segregation as has been ably shown by de Meijere in *Papilio memnon* of Java, (1910, pp. 161–181). But there is no information of any such thing occurring in the genus *Coenonympha.*

CATEGORIES BELOW THE SUBSPECIES

When I first surveyed the literature of the Palaearctic members of the genus, I soon found myself swamped in a vast number of names. Many days were required to weed out the important literature from that on aberrations and undefined forms proposed by many Continental "splitters." As will later be seen, many of the species vary tremendously in number of ocelli, concentration of dark scaling above and below, strength of the metallic marginal line, etc. This has allowed a "field day" for the so-called entomologists who wished to add a few names to the known forms of Lepidoptera by describing individuals with an extra ocellus or point, or with more or less slight color deviation from the normal population. The genus has approached the "*Parnassius* stage."

I have followed the practice of most American entomologists by

abandoning aberrations. Individual variations and undefined forms by common consent deserve no status.

However, in my abandonment of seasonal names, I have received considerable criticism. It is, of course, understood that the only purpose of taxonomy is to aid students of the various phases of the biology of the animals concerned, and it has often been said that when this viewpoint is lost to the taxonomist, when he loses sight of the status of the animals in nature, he becomes little more than a cataloguer and classifier. Consequently it must be admitted that when one abandons the use of seasonal names he runs the chance of being censured by those who feel that seasonal names will aid the ecologist, for instance, in keeping straight certain groups below the subspecies as defined above, commonly existing in nature. I would make the point that it is for the ecologist first to find out what the place in nature of these groups and forms is, before a name is applied to them.

However, as has been said, we are aiming at stability and as much simplicity as possible in our classification. The survey of the genus has shown that we have different types of seasonal variation, as exemplified by *C. tullia california* on the one hand and by *C. pamphilus* on the other. The former has two distinct seasonal varieties throughout its range. If all cases were like this one, the retention of seasonal names would not complicate the taxonomy too greatly. In the case of the latter, however, we become inextricably tangled in a welter of names if we attempt, as Verity has done, to use seasonal ones. *Pamphilus* is double and at times triple brooded. In the southern parts of its range the insect commonly occurs where there is a great range of altitude, in the Alps, the Pyrenees, the plateaux of Italy, Spain, Portugal, etc. The seasonal forms, of course, vary with a change in the environment, and yet there seems to have been no study of the changes in environment and the number and types of seasonal forms occurring therefrom. Plainly many factors are at work here about which we know little; whether they be altitude and the consequent change in precipitation and temperature, or foodplant change, is not known. Furthermore, no one has stated whether or not the seasonal forms are regular in one locality over a period of years.

The point to be made is that if we are to include seasonal forms in our taxonomy, a long and careful study must be made of a vast number of specimens with accurate altitude, date, dry and wet season, and, of course, locality data. Here we have a problem outside the scope of such a paper as this. Furthermore, the study should be made by one who has experimented with the biology of the forms and gained an

intimate knowledge of their typical environment. Such a study could take years; without doubt would be profitable and would teach us much of the ecology of the animals concerned. It is thought that many taxonomists are putting the cart before the horse; naming is being done with no understanding of the status of the animals in nature. Seasonal forms cannot be retained in one population and abandoned in another; there is no place where a line can be drawn. I have abandoned the naming of seasonal forms because they constitute a problem outside the main one of demonstrating the relationship of populations. This does not mean, however, that a discussion of the variation within each subspecies, in so far as I know it, has been omitted.

SYNONYMY, ARRANGEMENT

Following the trinomial formula and reference to figures, if any, I give the synonymy. In all cases the first author quoted first described or figured the population as it stands here; the original description that follows is his unless otherwise noted. Subsequent names, including those of authors who placed the insect in different genera, follow in chronological order. If the specific or subspecific name used by any author quoted was not first employed by him, his name is preceded by a comma. I have quoted only those figures which I consider clearly portray average individuals of the population concerned.

I have in all cases attempted with the kind help of Captain Hemming to determine the earliest valid name with a recognizable description ever applied to each population.

If the original description of the insect is too brief or incomplete or if it includes populations which must now be recognized as distinct, as is the case in many descriptions of an early date, I have followed it with a discussion of the appearance of the insect and the variation in the population as it stands here. There then follows discussion of any nomenclatorial problems. Reference to the life-history of the subspecies, if it is known, is then given and following this the range of the insect.

In the collections visited some types were examined, and in these cases the fact has been noted. I was unable to examine many of the types of species described in the eighteenth and early nineteenth centuries, as well as a few of insects described fairly recently by private collectors. It is felt that it was particularly unfortunate that an examination of the types in Leningrad (Alphéraky, Eversmann, Ménétriès, etc.) could not be made.

At various points throughout the taxonomy I have inserted discussions of problems involving the distribution of certain complexes or species or of the papers of other writers.

There are one or two cases in which I have seen absolutely no material at all; I have naturally had to arrive at the status of these forms through the literature, and this fact I have noted.

Throughout the paper the following abbreviations have been used:

MCZ	Museum of Comparative Zoölogy, Harvard University.
AMNH	American Museum of Natural History, New York City.
PANS	Philadelphia Academy of Natural Sciences.
USNM	United States National Museum, Washington, D. C.
CAR	Carnegie Museum, Pittsburgh, Pa.
CNC	Canadian National Collection, Entomological Branch, Ottawa, Ont.
COR	Cornell University Collection, Ithaca, N. Y.
MCG	Peter Redpath Museum of McGill University, Montreal, P. Q.
BM	British Museum of Natural History.
OB	Oberthür Collection at the British Museum of Natural History.
LS	Linnean Society of London.
RO	Rothschild Collection, Zoological Museum, Tring, England.
BER	Museum für Naturkunde, Berlin.
DR	Museum für Tierkunde im Zwinger, Dresden.
STB	Collections of the Firm of Staudinger-Bang-Haas, Dresden-Blasewitz.
MUN	Zoologische Anstalt, München.
WIEN	Naturhistorisches Museum, Wien.
OSLO	Universitetets Zoologiske Museum, Oslo.

MORPHOLOGY

Coenonympha are small, dull ochre to reddish to dark brown, or occasionally grey to white Satyrids. The lower surfaces of the wings generally bear ocelli or points, an apical one or more on the primaries and a submarginal row on the secondaries. There is more or less post-discal pale banding on both primaries and secondaries; considerable of the subspecific differentiation depends on the variation in this character and in the development of the ocelli. A marginal metallic line is characteristic of several species.

Schwanwitsch (1935) has written extensively on the evolution of the

color pattern of *Coenonympha* (among other genera), but it is most difficult to weed out of his mass of information points of value in determining relationships. Of interest is his figure of the archetype *Coenonympha* color-pattern, which I take the liberty of reproducing (fig. 1).

The biology of only a few species is known. The larvae (fig. 32), delicate and often greenish, with a dark dorsal stripe, have an anal fork. They feed, as far as is known, on Gramineae and Cyperaceae. Some (*tullia, oedippus*) being swamp-inhabitors, are probably able to undergo periodic inundations during their hibernation in the larval stage. The pupae are often pale green or grey with dark markings that break up their appearance and cause them to blend with the sticks, stones or grass-stems from which they hang, close to the ground. The majority of species are single brooded but some, as *pamphilus, arcanioides, tullia, california,* have two or more.

The eyes of *Coenonympha* are naked, not haired. The antennae are short, annulated, not strongly clubbed, and less than half the length of the costa.

Certain characteristics of venation, androconia, palpi, and genitalia are of diagnostic significance:

VENATION

Fig. 2 shows the venation of *oedippus,* which is typical for the venation of *Coenonympha,* except, in minor respects, *haydenii* and *semenovi.* In all species we see the bases of Sc, Cu, and 2A strongly swollen; this occurs in other Satyrid genera such as the related *Triphysa* and *Lyela.*

In the individuals of one species there is variation in the points at which R_1 and R_2 spring from R (figs. 3, 4, 5). R_1 may spring considerably within the end of the cell or nearly at the end. R_2 may spring within the end of the cell, exactly at it or slightly beyond it. Furthermore the upper-discocellular vein, UD, varies in length, and when it is absent, R, M_1, and the middle-discocellular, MD, may meet at the same point. The middle- and lower-discocellular veins, MD and LD, make a strong inward angle, the point of which sends a short projection into the cell as a continuation of M_2; at times, however, MD alone is bent and sends a projection into the cell approximately half way between the points of juncture of M_1 and M_2.

In the secondaries there is a knob-shaped precostal vein, PC; LD is longer than MD and UD, which are approximately equal.

Haydenii (fig. 6) differs from other species in certain minor respects.

Primarily, the bases of the three main veins are not as strongly swollen, though they are quite noticeably so. R_1 has a tendency to spring either just within or exactly at the end of the cell, R_2 considerably beyond the end of the cell. In the secondaries there is a tendency to the reduction of UD to make MD and LD more the same length.

Semenovi (fig. 7) only differs from the typical venation in that the bases of the three main veins are not as strongly swollen, even less so than those of *haydenii.*

ANDROCONIA

As Mr. Warren has ably shown in his "Monograph of Erebia" (1936), the androconial scales on the primaries of male Satyridae can be of great taxonomic importance. In the summer of 1936 he suggested to me that these scales might be present in *Coenonympha,* and fortunately, for I found them to be present only in certain species and discovered that those in different species are very distinct from one another.

The method given to me by Mr. Warren for the quick examination and permanent preservation of these scales is perhaps worthy of mention. One part of egg albumin in ten parts of water is shaken up with a few grams of thymol and filtered. With a needle this is spread thin on glass slides and allowed to dry. A "mounting board" is constructed with the groove slightly wider than the body of the insects to be examined and deeper than the pin, so that the insect may hang by its wings. After a prepared slide has been breathed upon, it may be pressed firmly down on the primary of the insect in place on the board, and when this is raised many scales will be found adhering to its surface. If a permanent slide is desired, the scales had best be left dry under a cover slip cemented only at its periphery by droplets of liquid cement or balsam; if this cement or balsam covers the scales they become too transparent for study. The examination of rare species can be made in this way, since with care absolutely no damage is done to the insect and not enough scales are removed to change its appearance.

In *Erebia* it was shown that certain species show the transition in development of androconial scales from what Mr. Warren calls the eomorphic stage through the palaeomorphic to the neomorphic or most advanced type. He says:

"The first recognizable step in the development of the androconial scale is represented by a scale very much the shape of the ordinary scale, starting from a pointed base, expanding rapidly to its full width,

and continuing so with more or less parallel sides to its termination, where the end is armed with a series of spikes, finer than those normal to the ordinary scale, but, equally coarser than those of the fully developed androconial scale. The pigmentation of this first-stage scale is an absolute compound of the pigmentary characteristics of the ordinary scale and the known androconial scale. At the base the dark lines of dots are still in a perfectly regular order, but soon they pass into the true androconial conglomeration of intermingling blotches of massed spots, which state continues to the termination of the scale. . . .

"There is a great range of variation in the terminal spines, or bristles, in these first-stage androconia; they may take the form of heavy spikes, approximating to those of the ordinary scale . . . , or much finer bristles . . . which are much further advanced toward the true androconial bristle.

"In the second stage the androconial characteristics of the first-stage scale are considerably further developed, with a proportionate decrease in the affinities to the ordinary scale. The sides are no longer parallel throughout, but taper markedly towards the termination, while a more or less circular neck immediately before the final tuft of bristles is distinct, though short and usually of moderate thickness, and contrasts very markedly with both the absence of any neck in the first stage and the long delicate shaft of the third. The terminal bristles on the scale of the second stage are much finer and more numerous than those of the first stage, and the pigmentation throughout is completely of the androconial type. . . .

"The third stage, that of the familiar androconial scale, is principally characterized by the development of the terminal shaft. This varies greatly in length and to a less degree in thickness. . . ."

The palaeomorphic or second stage is predominant in Coenonympha; eomorphic scales occur sporadically, neomorphic never.

I have examined the males of every described species except *sinica* and *mangeri*. Unfortunately I have been unable to obtain males of these forms; an examination might be of value in determining their affinities.

Androconial scales are present in: *amyntas, amaryllis, symphita, pamphilus, thyrsis, dorus.*

Some individuals of *amyntas amyntas* and *amyntas iphicles* seem to have no androconial scales, but others have a very few early palaeomorphic ones (figs. 8, 9). These have little or no arborization and but for their gradual tapering might be compared with Warren's eomorphic type, inasmuch as they have part parallel and part granular pigmenta-

tion. A slightly more advanced type is found in Aragonese and Catalan *amyntas pearsoni* (fig. 10). Cuenca *amyntas iphioides* (fig. 11) show the greatest development in this chain of populations, numerous scales in a more advanced palaeomorphic stage with heavy brush-like arborization. Fig. 12 shows an eomorphic scale in *iphioides*. The relationship of *iphioides* with *amyntas* is established by this continuous chain of a progressively developing morphological character. It is of interest to note that *leander* was found to possess no androconia, hence *iphioides* is not closely related to it. The one male of *mahometana* examined possessed no androconia.

The numerous early palaeomorphic scales of *amaryllis* and its subspecies (figs. 13, 14) are only slightly advanced over those occurring sporadically in nymotypical *amyntas*. The bases are narrow, the sides are nearly parallel, the neck with scarcely any appreciable constriction and the arborization not well developed. *Tydeus* of Szechwan (fig. 14) and the other subspecies possess scales indistinguishable from those of the typical subspecies.

The scales of *symphita* (fig. 15) of Transcaucasia are very close to those of *amaryllis* and show that *symphita* must be considered closer to *amaryllis* than to *tullia* which is completely without scales. The scales of *symphita* are possibly slightly more primitive than those of *amaryllis*, inasmuch as the arborizations are even less strongly developed.

Pamphilus (figs. 16, 17) possesses numerous, slightly pigmented, early palaeomorphic scales that can be well compared with those of *amaryllis*. They are slightly more advanced, however, the constriction at the distal end being more marked. The scales of the second generation of the subspecies *lyllus* (fig. 17) cannot be distinguished from those of the northern subspecies.

The scales of *thyrsis* are markedly distinct from those of *pamphilus*. They are wider and more squared at the base, taper more rapidly and have a greater constriction at the neck (fig. 18). They are in a later palaeomorphic stage. If the direction of evolution of these scales as postulated by Mr. Warren is correct, then this form has more advanced androconial scales than *pamphilus*, and Verity's (1926) theory that *thyrsis* is the relict ancestral form of *pamphilus* may not be tenable.

Dorus and its subspecies (figs. 19, 20) have the most advanced androconial scales in the genus. They are in an advanced palaeomorphic stage with the neck greatly narrowed and approaching the thread-like appearance of those of neomorphic scales. It will be noticed that the scales of *nicholasi* (fig. 20) cannot be readily dis-

tinguished from those of the nymotypical subspecies; in the African forms, however, there seems to be a tendency for the scales to be more numerous and more widely distributed.

PALPI

Fig. 21 shows the palpus of *oedippus,* typical for the genus. Reuter, in his monumental work on the palpi of Rhopalocera (1897) places the genus in the tribe *Ypthimidi* along with *Ypthima, Xois, Triphysa* and *Zipaetis.* He describes the palpi of *Coenonympha* as follows:

"Palpen über den Kopf hervorragend, von ähnlicher Gestalt wie bei *Ypthima.* Basalglied verhältnismässig kürzer als bei dieser Gattung. Mittelglied 2½–3½ mal so lang wie das Basalglied, cylindrich oder fast unmerklich sich verjüngend, sehr schwach wellenförmig gebogen. Endglied ungefähr wie bei *Ypthima.* Behaarung der Bauchseite sehr dicht, aus sehr langen, aufrecht stehenden feinen Haaren, bisweilen ausserdem aus weniger dicht stehenden, an ihrem Ende erweiterten, schuppenähnlichen Haaren bestehend; die Innenseite mit grossen breiten, gerundet eiförmigen, ungezähnten oder gekerbten, anliegenden Schuppen undicht bekleidet; der Haarkamm auf dem Rücken des Mittelgliedes distalwärts allmählich höher werdend; das Endglied mit Schuppen und kurzen angedrückten Haaren dicht besetzt."

Concerning the naked area bearing the sensory cones and pits at the base of the inner surface of the proximal segment, he says:

"Basalfleck 3/7–1/2 der Lange des Basalgliedes einnehmend, nicht merklich länger als breit, am distalen Ende bisweilen etwas vorgezogen, überhaupt nicht bestimmt begrenzt, am proximalen Ende quer abgeschnitten oder nur sehr unbedeutend ausgeschwungen und abgerundet. Die Anschwellung sehr schwach erhaben, meistenteils fast unmerklich, unbestimmt begrenzt. Das von den Kegeln eingenomene Gebiet ist selten über den grössten Teil des Basalflecks ausgedehnt (*Hero, Arcania*); es erstreckt sich öfters bis zur Nähe der vorderen Schuppengrenze, ist aber zuweilen recht klein, von eiförmiger bis fast kreisrunder Gestalt und auf das mittlere Drittel der Breite und zwar auf die proximale Hälfte der Länge des Basalflecks beschränkt (*Oedipus, Iphis*). Kegel schwach entwichelt, oft sehr kurz, undicht stehend, an den peripherischen Teilen und zwar besonders auf dem distalen Ende des Gebietes am kleinsten, fast gerade, spitzig. Auf dem distalen Teil des Basalflecks, unmittelbar vor dem Kegelgebiete, kommen mehrere recht grosse und deutliche Gruben vor. Chitin licht hellgelblich."

There seems to be some variation in the amount of space occupied by the sensory organs. This does not seem regular, but to determine accurately if there is regularity, longer series would have to be examined than are at my disposal; with such small insects it is difficult to remove the basal segment of the palpus for examination without destroying the entire head.

Haydenii (fig. 22) departs from the rest of the genus in that the last segment of the palpus is twisted and much reduced in length.

GENITALIA

Mr. Warren has shown (1930, p. 107) that Satyrid genera can be defined in general terms on certain characteristics of the male genitalia and gives a table of these characteristics. He states that he had not examined many *Coenonympha;* revising his table so that the section on *Coenonympha* applies to all species we have:

1. The combined tegumen and uncus are together shorter than or equal to the clasp.
2. The uncus is longer than the tegumen.
3. The dorsal ridge of the uncus is slightly to strongly convex.
4. The brachia are directed obliquely to the uncus (but do not always pass above it—*oedippus, haydenii*).
5. The aedeagus is straight or undulating.
6. The penis-sheath is weakly developed.
7. Lateral lobes of the saccus are wanting.
8. Shoulder processes of the clasp are wanting.

In the past there has been considerable difference of opinion as to whether the genitalia of *Coenonympha* are or are not of taxonomic value in the differentiation of species. I have found that for certain single species, distinct in other respects, they are, but for the mass they are not. Most of the arguments for the taxonomic use of the genitalia in this larger, homogeneous group have been based on a paper published by P. A. H. Muschamp in 1915. This paper is a phylogenetic classification of the genus based on the genitalia of the species he had at hand.

It is unfortunate that Muschamp did not limit his discussion to *iphioides* and its habits, for many of his conclusions and statements regarding distribution (particularly in the New World) and relationships are fantastic.

Although we must admit that *tullia* (=*tiphon*) gives a general im-

pression of primitiveness, particularly when we consider the wing-pattern, Muschamp's "proofs" of its great phylogenetic age are highly questionable. Its widespread distribution and at the same time its limitation to the cooler, moister boreal and subalpine areas of the Holarctic region, does not necessarily show it to be the most ancient form, widespread in the last period of generally warmer and lower lying lands in the earth's history. Had Muschamp studied more carefully the distribution of *tullia* he would have seen that its movements have most probably been dependent upon changes in the glaciation of the Holarctic region and its ranges (see figs. 30, 31).

Genitalic examination has led him to such conclusions as that *iphioides* is a southern form of *tullia.* The former we can relate definitely to *amyntas* by a transition form and, as we have seen, by its androconia; hence Staudinger's original judgment is correct. Muschamp considers *mathewi* a distinct species from *dorus!* Although he notices its differing characteristics, he includes *oedippus* in a group with *tullia, iphioides* and *nolckeni,* even after examination had showed him that its genitalia (figs. 23, 24) are markedly distinct from all other forms.

I have been unable to find the "regularities" of Muschamp; I feel that were I able to examine the genitalia of a thousand specimens, I could not with certainty distinguish those of the species of Group IV below, even those of the species of the group, mentioned below, a percentage of which seem to offer minor variations in a given direction. I defy anyone to separate on *regular* genitalic differences *tullia* from *amyntas* from *pamphilus* from *hero*, etc. I am afraid, therefore, that much of Muschamp's phylogeny, based on characters that are not regular and that can hardly be distinguished from changes occasioned by the removal and manipulation of the parts for examination, is of no value. He deserves credit, however, for establishing definitely and for the first time, on genitalic evidence, the continuity of the *arcania-darwiniana-gardetta* series.

In *Coenonympha* there are four main genitalic types:

I. *oedippus* (figs. 23, 24).
II. *haydenii* (fig. 25).
III. *semenovi* (fig. 26).
IV. all other species (figs. 27, 28)—the *arcania*-complex (fig. 29), *nolckeni*, and *leander* offer minor variations.

Fig. 23 shows the genitalia of *oedippus.* The shape of the uncus, deep, flattened laterally, generally beak-shaped and coming to a sharp point, is evident, as is the width of the proximal end and rapid tapering

of the clasps. From ventral view (fig. 24) the truncated clasps are well seen with their dentate, inwardly extended edge.

Fig. 25 shows the genitalia of *haydenii;* the extended, sharply bent downward uncus and the wide proximal end of the clasps, tapering sharply, are evident.

Fig. 26 shows *semenovi* to be close to Group IV, but the wider proximal end of the clasps and rapid tapering are also characteristic of this species.

Figs. 27 and 28 show the genitalia of *tullia benjamini;* they may be taken as typical for Group IV and therefore the majority of *Coenonympha* species.

Fig. 29 shows the end of the clasp of a specimen of *arcania gardetta* (=*satyrion*=*philea*) from the Upper Engadine. Slightly proximal to the end of the clasp can be observed a small dentate "shelf" or comb extending dorsally and inward. In each subspecies of *arcania* there is considerable variation in the amount and development of this comb. The tendency, however, is to have it reach its greatest development and most frequent occurrence in *gardetta;* nymotypical *arcania* often have only a trace of the comb, but in some specimens it is well developed. I have observed it in *orientalis.* I feel that the affinity of *gardetta* with *arcania* is thus well established.

Arcanioides shows the merest beginnings of a comb.

A comb also appears in *leander;* in regards to color also it seems closest to *arcania.*

In *nolckeni* the uncus seems regularly stouter than is usual in Group IV.

On the basis of the above morphological differences I have divided the genus *Coenonympha* into four groups: the *Chortobius*-group, the *Semenovi*-group, the *Haydenii*-group, and the *Oedippus*-group. The closest genera to *Coenonympha* seem to be *Lyela* Swinhoe (=*Dubierebia* Muschamp) and *Triphysa* Zeller. *Lyela myops* and its subspecies seem to connect *Coenonympha* with *Erebia.* It has been considered an *Erebia* because of its markings and color and a *Coenonympha* on the basis of its venation and its genitalic characteristics, which fall directly in the above definition. It seems best, however, in spite of these resemblances to put this insect in a distinct genus as have Swinhoe (1908) and Muschamp (1915) because of its Erebeoid pattern and because of its possession of heavily clubbed, spatulate antennae.

Triphysa Zeller resembles *Coenonympha* in venation but differs in wing-shape, pattern and genitalia. The uncus is only very slightly longer than the tegumen which is noticeably domed, the brachia are

much reduced, the clasps are heavier and noticeably extended upwards at the tips.

THE DISTRIBUTION OF THE GENUS

Coenonympha inhabit western and northern North America. They seem not to have invaded the central United States nor the eastern states. They inhabit much of Eurasia from the Arctic wastes south to a line marked generally by Morocco, Tunisia, Syria, northern Persia, Afghanistan and the Pamir. They do not seem to be found in the desert wastes of central Asia but are common in eastern and central China and Thibet extending in mountainous regions as far south as the upper reaches of the Brahmaputra. They occur only sporadically south of the Yang-tze (Figs. 30, 31).

THE GENERIC NAME

I quote Captain Hemming (1934, pp. 43–44):

"*Coenonympha* Hübner, (1823), Verz. bekannt. Schmett. (5): 65.
Butler, 1868, Ent. Mon. Mag., London 4: 194.
Kirby, 1894, in Allen's Nat. Libr. Handbook Lepid. 1 Butt. 1: 219.

Type. *Coenonympha oedipe* Hb., (1823) (*Papilio oedippus* Fab., 1787).

From the eleven species given by Hübner, Butler selected as the type *oedipe* Hb. (which he referred to under the name *geticus* Esp. given by Hübner as one of its synonyms). Kirby's later selection of *tiphon* Rott. is, of course, invalid.

Chortobius (Dunning and Pickard), 1858, Accentuated List Brit. Lep.: 5.
Doubleday, H., 1859, Zoologist Syn. List Brit. Butt. ed 2: 2.
Moore, 1893, Lep. Ind. 2 (14): 51, 52.

Type. *Papilio pamphilus* Linn., 1758.

"This name which was attributed both by Dunning and Pickard and by Doubleday to Guenée was introduced for *davus* Fab. and *pamphilus* Linn. The latter species was selected as the type by Moore. The name is, however, not required, as *pamphilus* Linn. is congeneric with *oedippus* Fab., the type of *Coenonympha* Hb. The *Accentuated List* of 1858 is an anonymous work published by the Entomological Societies of Oxford and Cambridge. Hagen (1862, Bibl. ent. (1): 199) is the authority for attributing its authorship to Dunning and Pickard."

CHECK LIST

Chortobius-group

- *tullia* Müller (p. 236)
  - *tullia* Müller
  - *polydama* Haworth
  - *scotica* Staudinger
  - *davus* Fabricius
  - *suevica* Hemming
  - *chatiparae* Sheljuzhko
  - *bosniae* subsp. nov.
  - *italica* Verity
  - *occupata* Rebel
  - *rhodopensis* Elwes
  - *elwesi* subsp. nóv.
  - *eupompus* Stauder
  - *caeca* Staudinger
  - *subcaeca* Heyne
  - *witimensis* subsp. nov.
  - *viluiensis* Ménétriès
  - *siberica* subsp. nov.
  - *mixturata* Alpheraky
  - *kodiak* Edwards
  - *ampelos* Edwards
  - *eryngii* Hy. Edwards
  - *california* Westwood
  - *columbiana* McDunnough
  - *benjamini* McDunnough
  - *inornata* Edwards
  - *nipisiquit* McDunnough
  - *mcisaaci* Dos Passos
  - *ochracea* Edwards
  - *mackenziei* Davenport
  - *subfusca* Barnes and Benjamin
  - *furcae* Barnes and Benjamin

- *amyntas* Poda (p. 273)
  - *amyntas* Poda
  - *bertolis* de Prunner
  - *iphina* Staudinger
  - *iphicles* Staudinger
  - *pearsoni* Romei
  - *iphioides* Staudinger

- *mahometana* Alpheraky (p. 279)

- *sunbecca* Eversmann (p. 280)

- *amaryllis* Cramer (p. 282)
  - *amaryllis* Cramer
  - *accrescens* Staudinger
  - *rinda* Ménétriès
  - *tydeus* Leech
  - *emmonsi* subsp. nov.

- *sinica* Alpheraky (p. 287)

- *symphita* Lederer (p. 288)
  - *symphita* Lederer
  - *karsiana* Sheljuzhko

- *mangeri* Bang-Haas (p. 290)

- *hero* Linnaeus (p. 290)
  - *hero* Linnaeus
  - *sabaeus* Fabricius
  - *perseis* Lederer
  - *neoperseis* Frühstorfer

- *arcania* Linnaeus (p. 294)
  - *arcania* Linnaeus
  - *clorinda* de Sagarra
  - *darwiniana* Staudinger
  - *gardetta* de Prunner
  - *orientalis* Rebel
  - *skypetarum* Rebel and Zerny

- *arcanioides* Pierret (p. 299)

- *leander* Esper (p. 301)

- *nolckeni* Erschoff (p. 302)

dorus Esper (p. 303)
  dorus Esper
  microphthalma Oberthür
  mathewi Tutt
  bieli Staudinger
  andalusica Ribbe
  inframaculata Oberthür
  fettigii Oberthür
  nicholasi Rothschild
  austauti Oberthür

vaucheri Blachier (p. 309)

corinna Hübner (p. 310)
  corinna Hübner
  elbana Staudinger

saadi Kollar (p. 312)
  saadi Kollar
  mesopotamica Heyne

pamphilus Linnaeus (p. 313)
  pamphilus Linnaeus
  scota Verity
  lyllus Esper
  australis Verity
  marginata Heyne

thyrsis Freyer (p. 324)

mongolica Alpheraky (p. 325)

Semenovi-group
  semenovi Alpheraky (p. 326)
    semenovi Alpheraky
    leanotchka Hemming

Haydenii-group
  haydenii Edwards (p. 328)

Oedippus-group
  oedippus Fabricius (p. 329)
    oedippus Fabricius
    monticola Kolar
    magna Heyne
    annulifer Butler

TAXONOMY

THE CHORTOBIUS GROUP

Coenonympha tullia tullia

Papilio tullia Müller, 1764, p. 36; Hübner, (1799), pl. 52, figs. 243–244; (1805), Text, p. 41.
Papilio tiphon Rottemberg, 1775, p. 15.
Coenonympha philoxena Hübner, (1823), p. 65.
Satyrus davus, Godart, 1823, pp. 550–551.
Maniola tiphon, Meigen, 1827, pp. 154–155.
Coenonympha davus, Herrich-Schaeffer, 1844, 1, p. 84. (etc.).
Coenonympha typhon, Kirby, 1871, p. 99; Buckell, 1895, pp. 100–107, (partim); Oberthür, 1910, 4, pp. 49–52, (partim).
Coenonympha tiphon, Elwes, 1896, pp. 228–230, (partim); Rebel, 1904, pp. 175–176, (partim); Seitz, 1908, 1, p. 146, pl. 48 k; Rowland-Brown in Oberthür, 1913, 7, pp. 85–88, 123–126, 165–193, (partim).
Coenonympha tullia, Com. Gen. Nomencl., 1934, 2, p. 21.

Original Description. "PAP. NYMPHALIS *Tullia* alis subdentatis flauis: subtus fascia undata alba; margineque posteriorum ocellis septem. In agris."

Type locality. Fredriksdal.

♂ 34–37 mm. Brown-ochre above more or less dusted with dark scales at the margins. In some specimens the ocelli show through from below. On the under side the primaries are a clear brown-ochre as above, dusted at the apex and outer margin with light grey in fresh specimens. There is a pale postdiscal band which varies in length, an apical ocellus and one or more secondary ocelli or points. The secondaries are heavily dusted over with grey scales, the ground color lending a brownish tinge to the basal area. There is a broken postdiscal band of angular white marks and a marginal row of ocelli usually six in number. They vary in size, are generally small and at times obsolescent.

♀ ♀ a millimeter or so larger. Marked as the males but lighter above and below.

There is considerable variation in size and in development of ocelli in this subspecies as in all. From the Bavarian Alps (Mittenwald—RO) and Switzerland (Wallis—"*thimoites*" Frühstorfer, 1910a, pp. 54–55) come specimens which are at times larger than the typical and with larger ocelli. These seem to occur at random; hence it is felt they do not deserve subspecific status.

This is the nymotypical form of the familiar species that to most entomologists has been known as *tiphon*. The Committee on Generic Nomenclature (1934) has established the precedence of the specific name *tullia*. The subspecific name *tullia* should be restricted to the Continental insect with the range given below.

Biology. Zeller, 1865, pp. 29–30; Kirby, 1865, pp. 64–65, (translation of Zeller); Hofmann, 1893, p. 24; Gillmer, 1900a, p. 384.

Range. Locally distributed and limited to its swampy habitat, from Belgium and the eastern borders of France (Doubs, Hautes-Alpes—OB), eastward across Europe to west Siberia, generally between the 45th and 58th parallels. Holland, Germany, Scandinavia at least as far north as Wermland in Sweden (BM, MCZ), Switzerland, Austria, Czechoslovakia, Hungary, Rumania, Poland, USSR.

To the south it is replaced by *italica* in Italy, by *occupata, rhodopensis* and *bosniae* in the Balkans, and by *chatiparae* in the Caucasus. To the north in Scandinavia, the Baltic States and Russia it merges with *suevica*. It is evidently locally distributed across central and eastern Russia; the easternmost typical specimens I have seen are from Sejmonowsk, Central Urals (OB, BER) and Kainsk, West Siberia (RO). Dr. Kusnezov sends me the following localities marking its southernmost limits: "Kiev (Krutikovskij, Sovinskij), Podolia (Eichwald,

Chranevitsh, Czekanowski), Cherson (Shugorov, Obraztov), Taganrog (Alpheraky)," and for Asia "Berezov (Tshugunov), Omsk (Vnukovskij), Tomsk (Meinhardt)."

Coenonympha tullia polydama

Papilio polydama Haworth 1828, p. 16.

Hipparchia iphis, Stephens, 1828, pp. 64–66.

Papilio typhon, Jermyn, 1836, p. 47.

Coenonympha typhon, Kirby 1871, p. 99, (partim); Buckell, 1895, pp. 100–107, (partim); Oberthür, 1910, 4, pp. 49–52, (partim).

Coenonympha tiphon, Elwes, 1896, pp. 228–230, (partim); Rowland-Brown, in Oberthür, 1913, 7, pp. 85–164, pl. CXCV, figs. 8–12; pl. CXCVI, figs. 22–24; pl. CXCVII, figs. 25–36.

Original Description. "Alae anticae griseo-fulvae ocellis duabus posticis caecis. Alae posticae fuscae sed ad latus interius late albicantes, puncto ocellari caeco parvo postico versus angulum ani. Subtus anticae fulvo-fuscae, basi nigricantes, apice cinereae, fascia postica albida abbreviata transversa; inter hanc et marginem posticum ocelli 2 remoti pupilla obsoleta alba, iride nigra albo cincta. Posticae basi fascia lata nigricante extus dentata, fasciola albida irregulari terminata; pone hanc cinereae; ocellis 6 parvis quarum 3 dimidiatis et fere obliteratis, omnibus circulo albo cinctis . . ."

Type-locality. ". . . . comitatu Eboracense . . . "

This is the British "Middle Form." Oberthür's fine plate gives its appearance as well as actual specimens can. Series show that it is distinguishable from *tullia tullia* by the uniform gray-green ashy appearance of the underside of the secondaries, which has a pronounced brownish tinge in the continental subspecies.

For those interested in the variation of this form, its detailed range, and its relation to *scotica* (=*laidion*) and *davus* (=*philoxenus*) there is Rowland-Brown's excellent treatment with sketch map and plates in Oberthür (1913). However, we cannot retain the name established by Rowland-Brown; evidently continental specimens were not examined in large enough numbers by him to show that this form is distinct from it. Haworth's description of *polydama* is the first description definitely applicable to this population and his name should stand for the British "Middle Form."

Biology. Hudson, 1864, p. 9252; Stainton, 1865, pp. 17, 44–45; Buckler, 1865, pp. 65–66; 1886, pp. 35–36, pl. VI, figs. 3, 3a, 3b; Frohawk in Oberthür, 1913, 7, pp. 173–177, 187–192; Oberthür, 1913, 7, pls. 3, 6, (habitat); Frohawk, 1924, pp. 27–32, pl. 40.

Range. Scotland and England, from approximately latitude 56°

southward through Westmoreland and northern and eastern York and over all Ireland, wherever the species may exist (Killarney, Westmeath, Galway, Sligo, etc.—BM). See map in Oberthür, 1913, 7, pl. A.

Coenonympha tullia scotica

Papilio typhon, Haworth, 1828, pp. 16–17.

Coenonympha typhon laidion, Kirby, 1871, p. 100; Buckell, 1895, pp. 100–107.

Coenonympha tiphon laidion, Elwes, 1896, pp. 228–230; Rowland-Brown, in Oberthür, 1913, 7, pp. 85–164, pl. CXCV, figs. 1–7.

Coenonympha tiphon scotica Staudinger-Rebel, 1901, p. 66; Seitz, 1908, 1, p. 147.

Coenonympha typhon scotica, Barnes and McDunnough, 1916, p. 71.

Original Description. "(al. supra al. post. latius cinereo-marginatis, subt. obscurior ocellis subnull.)." Staudinger-Rebel, 1901).

Type locality. "Scotia; Hibern. (trans.)."

Rowland-Brown says: "In the characteristic *laidion* (*scotica*) the tendency of coloration on the upper side of the wings is from pale ochreous to whitish, in some extreme examples the hoary marginal white invading the greater part of the wing area. Often, also, the wings are devoid of ocellation, except that, in such cases, the apical spot of the fore wings remains obsolescent. Coming further south the ochreous becomes more tawny until it may assume the deeper hue of the Middle Form, though occasional northern examples are as strongly coloured. On the under side the Scotch *laidion* show a wide range of variation; the apical spot of the fore wings sometimes distinct, at others wholly wanting; while the same may be said of the antemarginal ocellations of the hind wings, but as a rule these spots are obsolescent, or even wholly wanting. Also the median band is generally cut short towards the center and the continuation (as in most southern examples) towards the anal angle wholly absent, or inconspicuous. The greenish-grey *pamphilus*-like ground color of the under side of the hind wings presents a generally hirsute appearance. . . . "

The female is very slightly lighter than the male.

Barnes and McDunnough, (1916) say: "*Laidion* which is figured by Borkhausen and described from specimens taken at Gladenbach, in the vicinity of Frankfurt on the Main, in Germany, is recognized by all prominent continental lepidopterists as being merely an aberration of *typhon* (=*tullia*) with the normal number of six well defined and white ringed ocelli on the secondaries reduced to one or two. Dr. Buckell . . . . applies the name *laidion* to a Scotch form with re-

duced ocelli, which is in any case not the true *laidion* but the race *scotica* Staud. . . . Dr. Buckell has been followed by most English entomologists, including Tutt and Rowland-Brown. . . . Both these gentlemen have overlooked the vast disparity in the type localities for *laidion* and *scotica* which amply confirms Staudinger's judgment; it is very questionable whether an aberrational name may be properly used for a racial form from another locality."

Biology. Frohawk in Oberthür, 1913, 7, pp. 173–177, 187–192 ("tiphon in the British Isles"); Oberthür, 1913, 7, pls. 1, 4, (habitat); Frohawk, 1924, pp. 27–32, pl. 40 ("tiphon in the British Isles"); Harrison, 1937, Entomologist, LXX, p. 2 (food plant).

Range. In Scotland, from the Orkneys and Hebrides southward to approximately latitude 56° (See map—Oberthür, 1913, 7, pl. A.) Apparently true *scotica* does not occur in Ireland.

Coenonympha tullia davus

Papilio davus Fabricius, 1777, p. 259.

Papilio philoxenus Esper, 1780, I, 2, pp. 25–27, pl. LIV, fig. 3; pp. 132–133, pl. LXXVII, fig. 3.

Papilio musarion Borkhausen, 1788, pp. 92–93.

Papilio demophile Hübner, (1790)–(1793), p. 10.

Papilio hero, Lewin, 1795, I, p. 50, pl. 23, figs. 5, 6.

Coenonympha philoxena Hübner, (1823), p. 65.

Maniola philoxenus, Meigen, 1827, pp. 152–153.

Hipparchia polydama, Stephens, 1828, pp. 66–67.

Coenonympha typhon philoxenus, Kirby, 1871, p. 100; Buckell, 1895, pp. 100–107.

Coenonympha tiphon philoxenus, Heyne in Rühl, 1894, p. 62; Elwes, 1896, pp. 228–230; Seitz, 1908, 1, p. 146, pl. 48d; Rowland-Brown in Oberthür, 1913, 7, pp. 85–164, pl. CXCVI, figs. 13–21. (etc.)

Coenonympha davus rothliebii Herrich-Schaeffer, 1851, 6, p. 18.

Coenonympha davus rothliebi Staudinger, 1861, p. 14. (etc.)

Original Description. "Medius. Alae anticae supra fulvae ocellis duobus atris coecis tertioque minutissimo vix distincto; subtus fascia alba ocellis duobus pupilla alba. Posticae obscuriores ocellis quinque aut sex coecis; subtus griseae fascia interrupta alba ocellis sex atris pupilla alba posteriore didymo."

Type locality. "Habitat *Hamburgi* Dr. Schulz, Kilonii Sehestedt."

Male brown-ochre above with the outer half of the primaries and the secondaries generally heavily dusted with dark scales. The ocelli show through from below. Underside of the primaries brown-ochre dusted

over with ashy scales at the apex. The postdiscal band is well-developed and there are two to four ocelli varying in size. The underside of the secondaries is dusted over with ashy, blackish scales, the white band is generally more strongly developed than in *tullia polydama* or the typical form, though often broken, and the five or six ocelli are markedly well developed, the last at times double.

Female marked as the male but lighter; generally darker than the ♀♀ of the typical form.

Inasmuch as Fabricius' description stressed the strongly developed ocellation in this subspecies and he described it from Hamburg where the form is characteristic in the peat-bogs nearby, there is no doubt that his name *davus* must stand.

Biology. Frohawk in Oberthür, 1913, 7, pp. 173–177, 187–192 ("*tiphon* in the British Isles"); Oberthür, 1913, 7, pls. 1, 4 (habitat); Frohawk, 1924, pp. 27–32, pl. 40 ("*tiphon* in the British Isles").

Range. Concerning its range in England, Rowland-Brown says: ". . . . the Southern Form begins to assert itself in the southern part of the county of Westmoreland among the mosses, and swampy moorlands. . . . Passing south across the County Palatine of Lancaster, and Cheshire it touches its southern limit in North Shropshire and Staffordshire reaching as far west as the Welsh marshes; as far east as Chartley and Chorlton Moss." (see map—Oberthür, 1913, 7, pl. A). This subspecies also occurs in Belgium (Hertogenwald, Campine—De Donceel, 1882), Holland (Lemke, 1936), and northeastern Germany (moors near Aachen, Hanover, Hamburg, Bremen, etc.).

Coenonympha tullia suevica

Papilio isis, Thunberg, 1791, p. 31.
Satyrus isis, Zetterstedt, 1840, p. 905.
Hipparchia demophile, Freyer, 1845, 5, pp. 97–98, pl. 439, figs. 3, 4.
Coenonympha isis, Herrich-Schaeffer, 1844, 1, p. 84; 1846, pl. 61, figs. 293–296; Ménétriès in von Schrenk, 1859b, pp. 43–44, (partim). (etc.)
Coenonympha tiphon isis, Wallengren, 1853, p. 15; Elwes, 1896, pp. 229–230; Seitz, 1908, 1, p. 147, (partim); Rowland-Brown in Oberthür, 1913, 7, pp. 165–171, 179–185. (etc.)
Coenonympha tiphon laidion, Aurivillius, 1888, p. 36.
Coenonympha typhon laidion, Buckell, 1895, pp. 106–107, (partim).
Coenonympha tullia suevica (nom. nov.) Hemming, 1936, p. 123.

Original Description. "Alae integrae, supra ferrugineae, seu ferrugineo-fuscae, unicolores absque ocellis. Subtus anticae ferrugineae fascia abbreviata alba pone medium, & pone hanc ocellus solitarius; posticae fuscae fascia undata

alba in medio & intra marginem ocellus pupillatus cum adjecto puncto albido coeco." (Thunberg, 1791).

Type locality. "Suecia . . . . Roslagia. . "

Smaller than the nymotypical subspecies, the males averaging 30 mm., the females slightly larger. The coloration above in both male and female is as in *tullia tullia,* the female being a light ochre only lightly dusted with grey on the upper surface. The insect is also marked as the typical; it often has a bluish-grey dusting below as *polydama.* The subspecies is mainly characterized by the very reduced or totally absent ocellation.

This insect cannot be identified with *scotica* of the northern British Isles, as it is regularly smaller and without the whitish shading at the margins. Its similarity to *tullia inornata* of eastern Canada and Newfoundland is very striking indeed.

The name *isis* has been used most indiscriminately for many unocellated forms in Europe and Asia. Hemming (1936) proposes the name *suevica* because: "Hübner's use of the name *demophile* in the Lep. Linn. as a synonym of *philoxenus* Esp. leaves the Lapland subspecies of *Coenonympha tullia* (Müller) without a valid name. Two names have been given to this subspecies, but both of them are invalid. The first is *Papilio isis* Thunberg, 1791, described from "Suecia, Roslagia," which is a homonym of *Papilio isis* Drury, 1773 (Ill. nat. Hist. 2: index and 6); and the second is *Hipparchia demophile* Freyer, 1845 . . . . described from "Lappland." The first of these names is invalid owing to its being a primary homonym of the identical name given eighteen years earlier by Drury to a different species, the second because it is a second homonym of *Papilio demophile* (Hübner) given by Hübner (as shown above) to another subspecies of the same species."

Biology. Nordström, 1919, p. 130.

Range. Locally in Norway, Sweden, Finland, Esthonia and northwestern Russia north of Lat. 58°. Snaasen (OSLO, BM); Akershus, Hedmark (OSLO); Ostfold, Buskerud, Telemark, Hordaland, N. Trondel, Finmark (Haanshus, 1933); "Lappland" (USNM, RO, BER); Ovikjokk, Lappland (BER); Archangel (BER); vicinity of Leningrad (BM, STB, WIEN); Reval (MUN); Lechts (MCZ, DR); "Esthonia" (BM, STB, WIEN).

Everywhere in the far north *tullia* becomes greyish above and below. I have seen specimens from Lullea, Swedish Lappland (RO) and Kuusamo, Finland (STB) that appear very much the same in color and markings as *mixturata* from Siberia. It is this form, evidently, that Herr Wahlgren, (Svensk Insektfauna, 1933, Lep. I, Macrolep. I,

Diurnals, p. 53) has described as *orstadii;* he writes, however, that the collector took it flying with *isis,* hence it cannot deserve subspecific status.

Evidently *tullia* has a circumpolar distribution locally from Northern Norway as far east as Coronation Gulf in arctic America.

Coenonympha tullia chatiparae

Coenonympha tiphon chatiparae Sheljuzhko, 1937, pp. 353–354.

Original Description. "Die Rasse ist recht variabel. Grösse und Gestalt denen von isis gleich. Die Färbung der ♂♂ variiert oberseits von gelbbraun bis dunkelbraun, bei den ♀♀ ist sie stets gelbbraun. Ozellenzahl sehr veränderlich, bei den ♂♂ fehlen oft die Ozellen gänzlich, öfters sind sie aber vorhanden, wobei auf den Vfl. eine subapikale Ozelle erscheint, die als ein leichtes Fleckchen auftreten kann, oder (seltener) als eine vollständige Ozelle mit dunkler Pupille und leichter Umhofung. Unterhalb dieser Ozelle finden sich bei einzelnen Stücken noch 1–2 meist nur als leichte Punkte angedeutete Ozellen. Auf den Hfl. variiert die Zahl der Ozellen (soweit solcher überhaupt vorhanden) von 1 bis 3, wobei auch hier die Ozellenentwicklung sehr verschieden ist. Nur ganz ausnahmsweise finden sich Stücke, bei denen, neben den drei Ozellen, noch Spuren 1–2 weiterer Ozellen zu finden sind. Bei den ♀♀ ist die Ozellenzahl fast ebenso variabel, doch sind hier die ozellenlosen Stücke viel seltener. Sehr charakteristisch ist die weissgraue, zuweilen leicht bläuliche Färbung der Befransung, wobei, dieses Weissgrau nicht selten auch auf die Fl. übergeht und bei einzelnen Stücken hier einen verhaltnismassig breiten Marginalsaum bildet.

Besonders auffallend ist die Unterseite. Bei beiden Geschlechtern findet sich auf den Hfl. keine Spur von Braun, sondern ist die ganze Fl'-fläche gleichmässig gross beschuppt, während die ziemlich entwickelte Behaarung (im Basalteile des Fl.) deutlich bläulichgrau ist. Auf den Vfl. ist eine graue Beschuppung besonders bei den ♂♂ stark entwickelt. Sie bedeckt hier den V- und Aussenrand und verbreitet sich vom letzteren basalwärts mindestens bis zur lichten querbinde, die proximal von der Subapikalozelle liegt. Bei einigen ♂♂ ist aber die graue Beschuppung derart entwickelt, dass sie sich auch basalwärts von dieser Binde verbreitet und manchmal sogar (wenn auch spärlich) die ganze Fl'fläche bedeckt, so dass der gelbbraune Grundton nur in der Fl'mitte durchscheint. Bei den ♂♂ ist die graue Beschuppung der Vfl. schwächer entwickelt, ist aber am Aussenrande doch etwas breiter als gewöhnlich bei isis, während sie am Vorderrande meist nur die Subapikalozelle erreicht und sich nur selten bis zur lichten Schrägbinde ausdehnt. Die Ozellen sind auf der Unterseite konstanter als oberseits; deren Zahl variiert hier von 2–6, wobei sie meist eine volle Entwicklung zeigne, also aus einer lichten Pupille mit schwarzer Umrandung und lichter Umhofung bestehen. Die weissen Zeichnungen sind reduziert: die Schrägbinde der Vfl. ist bedeutend schwächer als bei isis

entwickelt und verschwindet bei einzelnen ♂♂ (mit stark entwickelter grauer Beschuppung) fast ganzlich, die weisse Binde der Hfl. ist zu einem Fleck am Ende der Zelle reduziert, wobei dieser Fleck in keinerlei Verbindung mit der Vorderrande steht.

Wollten wir die Unterschiede von chatiparae im Vergleich zu isis kurz zusammenfassen, so müssten wir sagen, dass oberseits das Charakteristische in der weissgrauen Befransung und (zuweilen) auch Berandung der Fl. besteht, unterseits in der gleichmässig-grauen Beschuppung und blaulichen Behaarung der Hfl. wie auch in der starken Reduktion der weissen Zeichnungen beider Fl."

Type locality. " . . . . im Teberda-Gebiete (Nord-Kaukasus) in der alpinen Zone (2400–2800 m. Hohe) des Chatipara-Berges."

Biology. Undescribed.

Range. Mr. Sheljuzhko writes: "Uber die Verbreitung von *C. tiphon* in Kaukasien scheinen nur ganz ungenügende Litteraturangaben vorhanden zu sein. Für Nord-Kaukasus könnte ich momentar nur auf die Angabe von Jegorov (Izvestija Kavkazsk. Otdela Imp. Russr. Geograf. Obshtshestva, XVI, 1903, p. 16) hinweisen, der 1 Stk. dieser Art am Berge Karin-choch (Nördl. Hänge des Zentralen Kaukasus) anführt . . .

Aus Transkaukasien liegt mir *tiphon* nicht vor, er wird aber von Ménétriès (Catal. raisonné, 1832, p. 254) aus den Bergen von Talysh erwahnt, wobei Ménétriès schreibt, dass er 4 Stück von "Sat. davus? . . . absolument semblable a l'Isis de Thunberg" fand. Vielleicht handelte es sich um eine Form, die mit meiner *chatiparae* identisch war . . . . ?"

The likeness of this southern middle-altitude form to the form from higher latitudes, *suevica,* is of interest.

Types. MCZ (co-type).

Coenonympha tullia bosniae subspec. nov.

Coenonympha tiphon, Rebel, 1904, pp. 175–176, pl. V, fig. 10.

Expanse 34–39 mm. the largest and most heavily ornamented subspecies. Rebel (1904) describes this form and gives a most excellent illustration of it but does not see fit to name it. He says:

"Was nun das Aussehen der im Gebiete auftretenden Sumpfform anbelangt, von welcher mir ein bei Jaice von Mrs. Nicholl gesammeltes Pärchen vorliegt (fig. 10 ♂), so ist dies eine auffallend grosse (Vorderflüfellänge 21, Exp. 34 mm.) dunkelgefärbte Form, von deren sehr vollständiger Fleckenzeichnung namentlich das grosse blinde, schwarze, hellbraun geringte Apicalauge der Vorderflügeloberseite sehr auffalt. Letzteres ist bedeutend grösser als bei

irgend einer anderen mir bekannten *Tiphon*-Form. Auch in Zelle 2 der Vorderflügel findet sich beim ♀ ein deutlicher Augenfleck und auf den Hinterflügeln bei beiden Geschlechtern in Zelle 1–3 je ein hellbraun geringtes Auge. Auch die Unterseite zeigt eine reiche Augenenwicklung. Die Vorderflügel führen ausser den beiden Augen wie oberseits beim ♀ auch noch in Zelle 3 ein deutliches Auge, wogegen ein weiteres in Zelle 4 nur punktförmig auftritt. Die Hinterflügel zeigen eine Reihe von sechs gut entwickelten Augen, wovon jene in Zelle 3 und 7 die Grössten, in Zelle 5 und 6 die kleinsten sind. Sämtliche Augen der Unterseite sind gelb geringt. Auf den Vorderflügeln tritt, nur beim ♀ deutlich, eine fast gerade weisse Aussenrandsbinde auf, auf den Hinterflügeln, die gegen die Basis ziemlich lang grüngrau behaart sind, ein weisser Fleck in Zelle 2 und 5, welch letztere sich beim ♀ gegen den Vorderrand zu verlängert.

Diese norbosniche Sumpfform erinnert in der dunklen Färbung der Oberseite und der reichen Augenzeichnung sehr an die norddeutsche var. Philoxenus Esp. (*davus*), unterscheidet sich aber von derselben doch durch den Mangel der weissen Aussenrandsbinde auf der Vorderflügelunterseite beim ♂ und die viel schwacher entwickelte weisse Querbinde der Hinterflügelunterseite. Auch ist die Flügelform von var. *Philoxenus* eine etwas gestrecktere, wogegen die Stücke von Jaice die breite Flügelform der Stammform besitzen."

Type-locality. Lake Jesero, Bosnia.

Biology. Undescribed.

Range. Northwestern Bosnia. Jaice, (Nicholl—WIEN); Lake Jesero, (Elwes—BM).

Types. BM.

Coenonympha tullia italica

Coenonympha tiphon italica Verity, 1914, pp. 222–223; Gaede in Seitz, 1930, (Supplement), 1, p. 179.

Coenonympha tiphon molisana Dannehl 1933, p. 245.

Original Description. . . . "The dimensions are those of *iphis* (=*amyntas*) (30–35 mm. expanse) and therefore considerably smaller than other forms of *tiphon*, with exception of the race *isis* (=*suevica*) of the far north with which it cannot be confused because of the very peculiar coloring of the latter. The upper surface of both sexes corresponds pretty well to the true *tiphon* as regards color: The ♂ has a large marginal brown band which gradually becomes yellow towards the posterior, and on the secondaries there is generally left only a very small basal space; there is furthermore an apical and anal ocellus, but there are some without any ocelli whatsoever, and still others with very small ocelli on the secondaries, and all the intermediate gradations are common; we see that there is much variability in this respect. The ♀♀, which have a lighter yellow coloring (similar to that of *pamphilus*), generally have a faint trace of a narrow marginal stripe; and in those in which the stripe is clearer on the primaries the

secondaries are covered completely with a darker brown; the ocelli and bands show through from below and naturally vary as they do on that surface. The undersurfaces of the sexes are very similar, but the ♂ is slightly darker than the ♀ and has at the base a bluish tinge more strongly marked than in the ♀. Both sexes here resemble in coloring *iphis* and also many *pamphilus*, being a light gray (not mixed with brown as in the typical *tiphon*); in the ♂ the yellowish band on the primaries is very vague or entirely absent; the one on the secondaries is a dirty white and shaped as a triangle over the end of the discoidal cell; there are a few specimens which have a second very small triangle beneath the larger one; the five or six ocelli vary in size; in the ♀ the light band always exists and sometimes it crosses the entire wing, in these specimens the same can be said about the secondaries; in others, occurring more often, there are only a certain number of small triangles, rarely one as in the ♂; there are generally two ocelli on the primaries and six on the secondaries, but of very varying size." (Trans.)

Type-locality. "Monte Sibillini."

I have compared the types of *molisana* Dannehl (MUN) with specimens of *italica* from the type locality (Querci—MCZ) and they are identical; hence the name is a synonym.

Biology. Undescribed.

Range. Italy. Verity found this insect in the woods of Bolognola from 1300–1700 meters. Pescocostanzo, (RO); Monte Rotella (MUN); Bolognola, Monte Sibellini, (Querci—MCZ) and Mt. Paradiso, Montagna Grande, (Dannehl, 1933).

Coenonympha tullia occupata

Coenonympha tiphon occupata Rebel, 1903, pp. 181–182; 1904, pp. 175–176, pl. V, figs. 11–12; Seitz, 1908, 1, p. 147.

Coenonympha typhon occupata, Rebel and Zerny, 1934, pp. 77.

Coenonympha tiphon schmidtii von Dioszeghy, 1930, p. 209, pl. I, fig. 3, pl. II, fig. 8.

Original Description. ". . . fliegt eine der *Rhodopensis* ganz nahe verwandte *Tiphon*-Form, die such aber durch noch geringere Augenentwicklung auszeichnet. Das Apicalauge der Vorderflügel fehlt hier in der Regel auch auf der Unterseite vollständig und auch die Hinterflügel werden hier im männlichen Geschlechte oft vollständig augenlos."

Type-locality. "Auf den Gebirgen Bosniens und der Hercegovina . . ."

Male 31–32 mm., ochre dusted with dark scales at the margins. Below generally without ocelli or points and on both primaries and secondaries the pale mark appears anteriorly only. Female 34–36 mm.,

bright ochre above without the dark shading and lighter than the male above and below.

Specimens of *schmidtii* (von Dioszeghy—WIEN) were found to be indistinguishable from *occupata.*

Biology. Undescribed.

Range. Between 4000′ and 6000′ in the mountains of Jugoslavia (Croatia, Bosnia, Herzgovina, Montenegro) and Albania; probably locally distributed eastward at least as far as the Transylvanian Alps (Retyezat Mts.—von Dioszeghy). Prenj (BM, WIEN), Vitorog (BM), Ljuborica (BM), Zengg (RO), Vucijabara (BER, MUN), Jablanica (DR), Treskavica (WIEN); some Montenegrin (Durmitor—BM, WIEN) and Albanian specimens (Rebel and Zerny, 1934) show a transition to *rhodopensis.*

Types. WIEN.

Occupata and *rhodopensis* do not seem quite as sharply isolated from each other as do some other subspecies of *tullia.* There is a very gradual trend from the true *occupata* of Croatia and Bosnia through transition regions where the specimens have a tendency to vary one way or the other (Albania, Montenegro) to the true *rhodopensis* of the Rilo region.

Coenonympha tullia rhodopensis

Coenonympha tiphon rhodopensis Elwes 1900, p. 205; Rebel, 1903, pp. 181–182, pl. III, figs. 3, 4; 1904, pp. 175–176; Seitz, 1908, 1, p. 147; Rebel and Zerny, 1934, p. 77.

Coenonympha symphita tiphonides Staudinger-Rebel, 1901, p. 66; Seitz, 1908, 1, p. 146.

Original Description. ". . . they differ from normal European specimens in having in most cases the apical band of fore-wing below obsolete, but some specimens (about one third) show a trace of this band, and some of these cannot be distinguished from two specimens of *tiphon* from Stettin, and are very close to, but much larger and darker than, what I took in the Altai Mts. . . ."

Type-locality. Rilo Dagh, Bulgaria.

Males average 32 mm., females slightly larger.

Rebel, (1903), says: "Die Oberseite ist in beiden Geschlechtern meist hell gelbbraun, selten beim ♂ etwas verdunkelt. Von der Zeichnung der Unterseite schlägt nur der schwarze Kern des Apicalauges der Vorderflügel und des zweiten Augenfleckes der Hinterflügel (und diese nicht immer) durch.

Auf der Unterseite besitzen die Vorderflügel meist nur ein recht

kleines, gelb-geringtes Apicalauge, und nur bei einem ♀ (Fig. 4) der mir vorliegenden 22 Stücke finden sich schwache Spuren einer äusseren weisslichen Halbbinde, die bei der var. *Isis* sehr deutlich auftritt.

Die Hinterflügel sind daselbst ziemlich lang grunlichgrau behaart und besitzen meist eine vollständige, dem Saume parallele Reihe von sechs Randaugen, wovon das zweite vom Innenwinkel (nur bei einem ♂ ausnahmsweise das Costalauge) das grösste ist. Die Augenflecke variieren sehr an Grösse und verschwinden zum Teile ganz. Das in dieser Richtung am extremsten gezeichnete ♂ lässt nur mehr das erwähnte zweite Auge vom Innenwinkel ab und das Costalauge als Punkte erkennen, wogegen die übrigen ganz verschwunden sind. In der Regel findet sich nur unterhalb des Costalauges ein in der Grösse und Gestalt wechselnder weisser Fleck, als Rest der Halbbinde von *Tiphon*. Bei dem vorwähnten ♀ (welches den Rest der Halbbinde auf den Vorderflügeln besitzt) zeigen die Hinterflügel jedoch eine vom Vorderrande bis nahe an den Innenrand reichende, nach beiden Seiten stark verengte weisse Binde (Fig. 4)."

I have compared the type series of *rhodopensis* (BM) with that of *tiphonides* (STB) and find them to be the same. Elwes, (1900), says that after sending a specimen of *rhodopensis* to Staudinger, he received a letter saying: "This specimen agrees with four or five males that I received many years ago from Haberhauer from the Caucasus without exact habitat. I have described it as *symphita*, Led. var. *tiphonides*, and from these specimens consider *symphita* (which I received in quantity from Achalzich in Armenia) also as a probable form of *tiphon*." This series at Dresden-Blasewitz are unlabeled except for one specimen, "Cauc." It seems probable that Staudinger was mistaken about the origin of these specimens; there seem to be no insects which approach *rhodopensis* in the Caucasus, where, as we have seen, nymotypical *tullia* and an unocellated form occurs. In Transcaucasia occur *symphita* and *symphita karsiana* which are not, as Staudinger thought, closely related to *tullia* but more probably to *amaryllis*.

Unfortunately I have not seen Kolar's (1933) *carinthicus*. From his description the form seems to resemble *rhodopensis*. It is from the vicinity of Klagenfurt and may form the northern transition between the typical and *occupata*.

Biology. Drenowski, 1923, pp. 195–196.

Range. Between about 4000′ and 7000′ in the mountains of Montenegro, Albania, Macedonia, western Bulgaria.

Orosi, Korab, Djalica e Lumës, Vermosa—Albania (WIEN); Zljeb, Vinsaj—Montenegro (WIEN)—transition to *occupata*.

Pirin, Bandaritza, Buresch, Upper Rilska Valley—Bulgaria (Elwes, Nicholl—BM), Rilo Dagh—Bulgaria (Elwes—BM, WIEN).

Peristeri, Koblitza, Lisec, Shar-dag, Pepelak, Begova Valley—Macedonia (MUN).

Types. BM.

Coenonympha tullia elwesi subspec. nov.

Coenonympha tiphon var., Elwes, 1899, p. 363.

Close to *subcaeca* but larger, averaging the same size as *tullia* of western Europe. The sexes are alike, a light clear ochre, a few of the males having the upper side of the wings obscured with dark scales at the outer margins. They are marked as typical *tullia;* the white band on the secondaries varies, but the ocellation is generally well-developed. Characteristic is the blue-grey slaty shade of the apices of the primaries on the lower surface and of the outer margins of the secondaries; the basal area of the secondaries is slaty-bluish and hairy.

The resemblance of this form to both *italica* and *rhodopensis* is striking.

Type-locality. Altai Mts.

Biology. Undescribed.

Range. Elwes took this form "in the more marshy parts of the valleys (of the Altai) between 5000–7000 feet." Future collecting will probably show its range to be continuous from the Altai southwestward as far as the Ili region.

Bashkaus, Tchuja Mts., Arasan, Bamkari, Ongodai–Altai range (Elwes—BM); Tarbagatai Mts. (STB); Ili (Wagner—DR).

Type. MCZ.

Coenonympha tullia eupompus

Coenonympha caeca subcaeca, Wagner, 1913, p. 246, (?).
Coenonympha pamphilus eupompus Stauder, 1924, p. 152, pp. 153–154, (?).
Coenonympha caeca heptopotamica Sheljuzhko, 1929, pp. 352–354, (?).

Original Description. "Die Ilienser-Rasse *eupompus* hat im ♀ eine auffallende Ähnlichkeit mit *C. tiphon* sbsp. *occupata* Rbl. Beide Geschlechter auffallende bleich, etwas spitzflügliger, Saum beim ♂ noch angedeutet; das ♀ ist einfarbig ohne jede dunklere Besäumung, Apikalauge bei den Vorliegenden Stücken obsolet. Die Hfgl.-U.S. des ♀ von *eupompus* sieht jenen von *tiphon occupata* der art gleich, das man lediglich darin noch auf *pamphilus* schliessen kann, weil *tiphon* eine viel robustere und habituell stattlichere Art ist. Die *tiphon occupata* so eigentümliche helle Zacke auf der Hfgl.-U-S. ist bei *eupompus*

♀ geradeso geformt, der Gesamtton des ganzen Hfgls. ist ebenfalls *occupata*-mässig und verleugnet die Artcharakteristika eines *pamphilus* völlstandig. Nur die männliche Hfgl.-U.-S. mutet noch pamphiloid an, das helle, schmale Mittelband durchzieht lylloid den ganzen Hfgl. Basis und Rand der Hfgl.-U.-S. (des ♂) sind entönig hellbraun gehalten, jede Marmorierung fehlt. Die Hfgl.-Punktierung fehlt, nach dem Belegmateriale zu schliessen, gänzlich, bei keinem Stücke ist auch nur ein Anflug davon zu gewahren. 1 ♀ trägt noch einem lichten Analfleck und ein weissliches Saumpünktchen auf der Hfgl.-U.-S., so dass die täuschende Ahnlichkeit mit *tiphon occupata* noch mehr hervorgehoben word. Entfernte Anklänge bestehen nur zum ♀ f. *torrida* Vrty., doch ist die *eupompus* ♀—Hfgl.-U.-S. derart monoton graubräunlich gehalten, das beide leicht auseinanderzuhalten sind, auch wenn der *tiphon occupata*—Widerhaken und der tiphonide leichte Analfleck beim *eupompus* ♀ nicht da wären. . . . . " (Stauder, 1924).

Type-locality. "Iligebiet."

There seems to be no doubt that this insect of Stauder should be referred to *tullia* and not *pamphilus.* There is no distinct *pamphilus*-form in Asia; furthermore, I have seen perfectly typical *pamphilus* from the Semiretchensk (Ili) region (BM, OB, MUN). Dr. von Rosen has kindly lent me a male and a female *tullia* collected by Ruckbeil in the vicinity of Dzarkhent in the Ili region in 1913. The small size of this form and of *caeca* from the Namangan Mts. has led authors to believe them forms of *pamphilus;* I have, however, examined the Ruckbeil specimens as well as *caeca* specimens for androconia and found none. They are always present in *pamphilus* (see fig. 16); in *pamphilus* the apical ocelli are never obsolescent as they may be in these forms. We see that there is, through this Ili population, a gradual chain from *elwesi* of the Altai and Tarbagatai (unmistakably a *tullia*-form) to *caeca* of Turkestan; hence it and *caeca* must be considered subspecies of *tullia.*

Dr. von Rosen's two specimens agree absolutely with Mr. Sheljuzhko's (1929) description as *heptopotamica* of specimens also obtained by Ruckbeil. Unfortunately I have been unable to see Stauder's specimens or obtain photos of them. But Mr. Sheljuzhko says: "Nach der Beschreibung (Stauder's) zu urteilen, scheint es mir nicht ausgeschlossen zu sein, dass meine *helptopotamica* mit *eupompus* Stauder identisch wäre. In solchem Falle wäre natürlich *heptopotamica* als Synonym von *eupompus* einzuziehen, *eupompus* aber nicht als eine *pamphilus*-, sondern als eine *caeca*-Rasse einzureihen.

"Dieser Identität scheinen aber folgende Angaben der der Beschreibung Stauder's zu widersprechen:

"1. (Saum beim ♂ noch angedeutet)—der dunkle Fl'saum fehlt bei *heptopotamica* gänzlich.
"2. 'Das helle schmale Mittelband durchzeit (beim ♂) lylloid den ganzen Hfl.'—Bei *heptopotamica* (genau wie bei *caeca*) erscheint die Mbinde als eine ziemlich breite helle Halbbinde, die sich vom Vrande etwa bis zur Mzelle zieht und dann noch als ein weisser Fleck erscheint.
"3. 'Basis und Rand der Hfl.-U.-S. (des ♂) sind eintönig hellbraun gehalten, jede Marmorierung fehlt.'—Bei *heptopotamica* sind Basis und Rand der Hfl'useite etwas verschieden gefärbt. Der ganze Ton der Hfl'useite wäre etwa als ziemlich dunkel graubraun zu bezeichnen und ist dieser Grundton an der Fl'basis etwas grünlich beschuppt.

"Wegen der Apikalozelle sagt Stauder nur sehr kurz: 'Apikalauge bei den vorliegenden Stucken obsolet.' "

It seems possible that Stauder's specimens are slightly closer to *caeca* than are Mr. Sheljuzhko's or those of Dr. von Rosen, since in them the apical ocelli are obsolescent and the secondaries are more one color.

The status of Wagner's (1913) series also must remain doubtful, but they are certainly not *subcaeca*, which occurs only in the Sajan and Baikal region. I have seen two specimens (DR—ex Wagner, "Ili") that appear slightly closer to *elwesi* of the Tarbagatai than to the Ruckbeil specimens, but agree well with Wagner's description and may be part of the series he discusses.

At any rate, there seems to be an indistinct chain of forms from the Altai to the Namangan (from *elwesi* to *caeca*); tentatively we shall consider the Ili population one subspecies, *tullia eupompus*.

Size of Ruckbeil specimens from Dr. von Rosen: ♂ 28 mm., ♀ 32 mm.

Coenonympha tullia caeca

Coenonympha caeca Staudinger, 1886, pp. 251–252; Sheljuzhko, 1929, pp. 352–353.
Coenonympha tiphon caeca, Seitz, 1908, 1, p. 147.

Original Description. . . . . "Die Grosse (22–30 mm) ist die kleinerer Pamphilus und ist Caeca auf der Oberseite auch genau so licht ockergelb gefärbt, nur hat sie gar keine dunkleren Ränder und fehlt die Augenzeichnung vollständig, auch auf der Unterseite. Nur die Fransen sind lichter weissgrau, sonst ist die Oberseite von Caeca völlig eintönig ockergelb. Auf der Unterseite gleicht Caeca fast ganz der var. Isis Zetterst. von Typhon (Davus), nur fehlt die Augenzeichnung völlig und die Vdfl, sind vorherrschend ockergelb wie auf der Unterseite. Es ist bei ihnen nur der Apex grüngrau und vor dem-

selben steht am Vorderrande ein meist seht verloschener weisslichgrauer Längsfleck, der sich niemals bindenförmig bis fast zum Innenrande wie bei Typhon (meist) oder var. Isis fortsetzt. Auch fehlt diese weissliche Färbung einigen Stücken völlig und tritt sie nur bei einem ♀ seht deutlich, nach ihnen scharf begrenzt, fleckförmig auf. Die Unterseite der Htfl. bei Caeca is dunkler, weniger grüngrau als bei Isis, mehr graubraun, nur nach der Basis hin grüngrau, wie oft bei Typhon. Hinter der Mitte führt sie aber genau dieselbe unregelmässige, öfters nur aus 1–2 Flecken bestehende, gelbweisse Binde wie bei var. Isis und Typhon. Es ist daher nicht unmöglich, dass diese Caeca als Varietät (oder Stammform) zu Typhon gehören kann, obwohl sie kaum halb so gross und viel lebhafter ockergelb gefärbt ist. Auch der gänzliche Mangel von Augenflecken bei den 24 Stücken (mit 5 ♀), die ich davon erhielt, ist sehr auffallend, obwohl sonst das Verschwinden einzelner (und ausnahmsweise aller) diese Augenflecke bei den Satyriden nicht selten verkommt."

Type-locality. " . . . . auf den Gebirgen bei Namangan . . . "

This is the smallest known subspecies of *tullia;* the sexes are alike.

Biology. Undescribed.

Range. Russian Turkestan.

Namangan Mts. (OB, BM, STB), Pskem Valley (Evans—BM), Alexander-Kette, (BER); Sheljuzhko (1929) reports the insect "aus Aulie-ata . . . und Vyssokoje (in den sudl. Vorbergen des Kara-tau, Distr. Tshimkent . . .)."

Types. STB.

I have seen no specimens of *tullia* from Kashgar or its vicinity. Frühstorfer's *fermana* (1908, p. 10) should probably be referred to *amaryllis* or possibly *sinica.*

Coenonympha tullia subcaeca

Coenonympha caeca subcaeca Heyne in Ruhl, 1894, p. 827.

Coenonympha tiphon subcaecata Seitz, 1908, 1, p. 147.

Original Description. "Auf der Unterseite treten verloschene Spuren einiger kleiner Augenflecken auf."

Type-locality. "Südliches Sibirien."

29–30 mm., uniform, bright ochre above with little or no dark shading. Marked below as *suevica* from Scandinavia and the Baltic. The basal half of the secondaries below is often ashy-black and contrasts strongly with the marginal area. The white marks are strongly developed. There are very small apical ocelli and one to three very reduced ocelli or points on the secondaries. The female is slightly lighter than the male, not noticeably larger.

Unfortunately, I have not seen the types of this subspecies. If it

was described from specimens taken in a region further to the westward towards the Altai, the name may not stand for this insect. Inasmuch as all the specimens I have seen from southern Siberia, that possess mere traces of ocelli, fall into one geographic population, I have retained this name for it.

Although definite conclusions can hardly be drawn from as few specimens as I have seen in both Old World and American collections, there seems, as we have seen, to be a chain of subspecies from Russian Turkestan, where the small, unocellated *caeca* occurs, through the Ili region (*eupompus*) where occasional specimens occur, probably ♀♀, that approach *elwesi* of the Tarbagatai and Altai in appearance, to *subcaeca* of the Lake Baikal and Sajan Mt. region.

Because of the break here and because there is no apparent connection between this complex of subspecies and *tullia tullia*, some taxonomists would be constrained to consider as separate species the insects ranging from Turkestan to Baikal. *Tullia tullia* occurs at least as far east as Kainsk, Siberia. Possibly connecting specimens may be found between this region and the Altai, more probably transition specimens will be found between *subcaeca* and the Witim population.

In many cases the chains I have knowledge of are incomplete. As we know, *tullia* is rather specialized as to habitat; furthermore transition forms may have been exterminated in certain regions where they once existed to close the chain. Or more probably, further collecting in little-known regions will close the gaps.

At any rate, the Central-Asian complex again shows the convergence that so often occurs in color in this species. The likeness of *elwesi* to *italica* and *rhodopensis* has already been mentioned. Even more striking is the similarity between *subcaeca* and *ampelos* of the northwestern United States. There seems to be a bridge formed between two rather similar end forms via *mixturata*, common to Asia and America.

Biology. Undescribed.

Range. The Sajan Mts. and the region south of Lake Baikal.

East Sajan Mts. (BM, STB), Irkutsk (BM), Tunkinsk, Munko Sardyk (MCZ, CAR).

Coenonympha tullia witimensis subspec. nov.

Coenonympha tiphon isis, Herz, 1898, p. 249.

Very close to but distinct from *viluiensis*, which is greyer above and below. Approximately 30 mm., upper surface ochre-grey to ochre. Below, with little grey dusting except at the margins. The secondaries

have an olive-brown appearance, while the white banding varies but is well-developed and clearly delimited on its inner edge.

As Herz says, this form seems to make a link in the transition between *subcaeca* and *viluiensis*.

Type-locality. "Witim."

Biology. Undescribed.

Range. The Witim region (Christoph—BM).

Types. BM.

Coenonympha tullia viluiensis

Coenonympha isis viluiensis Ménétriès in von Schrenck, 1859, 2, p. 44.
Coenonympha tiphon grisescens Christoph, 1893, p. 87.
Coenonympha tiphon viluiensis, Alpheraky, 1897a, in Romanoff, 9, p. 197, pl. XIV, fig. 4; Elwes, 1899, p. 363; Seitz, 1908, 1, p. 147.

Original Description. "En dessus, les ailes sont d'un blanc grisâtre, à peine lavé de fauve, laissant apperçevoir, par une teinte plus clair, les bandes blanches du dessous; il n'y a aucune trace d'yeux.

En dessous, les ailes supérieures sont de teinte plus grisâtre, et même un peu verdâtre à la base, ayant le sommet blanchâtre, sur lequel se dessine un petit point noire peu marqué, et entouré d'une nuance blanchâtre; la bande blanche transversale est ombrée de gris à son bord interne. Les ailes inférieures ont leur bande transversale blanche, plus entière que les autres formes d'*isis;* le bord extérieur sablé de brun clair et de gris, n'offre aucune trace d'yeux ou de points.

Type-locality. " . . . . des bords de la rivière Viloui."

Approximately 30 mm., sexes alike. Alpheraky gives a most excellent figure of this insect.

Biology. Undescribed.

Range. Lena River region.

Vilui River (Elwes ex. Herz, Grumm-Grzhimailo—BM); Verchojansk District (Elwes, 1899).

Coenonympha tullia sibirica subspec. nov.

Expanse 32-36 mm. Dull ochre above, very lightly if at all dusted with dark scales at the margins, and with the dark continuation of the veins through the light fringe giving a somewhat scalloped appearance to the edges. Below, the primaries are a warm brown-ochre, the apex and outer margins dusted with grey and possessing one to three small ocelli or points backed by an irregular and varying pale line. The secondaries below are a darker and more olive brown than are the primaries, dusted with ashy scales at the base and pale green-

grey at the margins. The white marks are well developed and the number of small points varies from none to five. The sexes are alike.

Type-location. Seja (Amur region), Far Eastern Republic.

Biology. Undescribed.

Further to the north this form must merge into *mixturata* Alph., but it is uniformly larger and brighter.

Range. I have seen only five specimens—three males and one female in the collection of Lord Rothschild at Tring from Pompjejewka, Little Chingan Mts., Far Eastern Republic and the female that I have designated the type in the Zoologische Anstalt at Munich. Previous to seeing these specimens I had no idea that *tullia* ranged as far south as the Amur in Asia.

Type. MUN (♀).

Coenonympha tullia mixturata

Coenonympha tiphon mixturata Alpheraky, 1897b, in Romanoff, 9, p. 326; Elwes, 1903, p. 241; Cary, 1907, p. 448; Seitz, 1908, 1, p. 147.

Coenonympha kodiak yukonensis Holland, 1900, pp. 386–387; 1931, pp. 182–183, pl. LX., figs. 21–22; Skinner, 1900, p. 303; Dyar, 1902, p. 30; Weymer in Seitz, 1911, 5, p. 227.

Original Description. " . . . . Dem allgemeinen Habitus nach und durch das fast völlige Fehlen sowohl auf der Ober-als Unterseite, der Augen vor dem Rande, von denen, nicht einmal immer, nur ein weissliches unter dem Apex vorhanden.—nähert sich diese Form der var. *Isis* Thnbrg. Von den nordrussischen Stücken (incl. denen aus St.-Petersburg) und solchen aus dem Tarbagatai—soweit sie in der Sammlung des Grossfürsten vertreten,—unterschieden sie sich durch etwas grössere Dimension und durch die Färbung. Die ♀♀ stehen ihrer sehr hell bräunlichen Färbung nach am nächsten der Form vom Witim, die ein wenig vershieden von den Stücken aus Nord-Russland und dem Tarbagatai. Wie die ♂♂ anbetrifft, so bilden sie wegen ihrer ins Graue ziehenden Färbung einen Ubergang zur var. *Viluiensis* Men. (Schrenck's Reise und Forsch. p. 44); es ist dies eine sehr bemerkenswerthe Form vom Wilui, die aber später elandaselbst von Herrn Hertz in beträchtlicher Anzahl gefangen worden ist. Mit dieser var. *Viluiensis* (=v. Grisescens Chr. Iris Bd. VI. 1893. pag. 87) stimmt übrigens die Form von Kamtschatka durchaus nicht zusammen, da alle ♂♂ auf der Unterseite der Vorderflügel einen braunlichen Diskus, wie oben, haben, während bei der eigentlichen v. *Viluiensis* Men. derselbe grau ist nur in seltenen Fällen einen bräunlichen Anflug hat. Durch etwas intensiveren bräunlichen Anflug nähert sich nur ein ♂ vom Wilui einigen hellen Exemplaren von Kamtschatka."

Type-locality. Kamtschatka.

Average 32–33 mm.; the females are slightly larger and lighter than the males.

American specimens become slightly lighter in eastern Alaska and the Yukon, but the populations on the opposite sides of the Bering Strait have not been long isolated and are hardly to be considered distinct.

Biology. Undescribed.

Range. Northern Siberia from Long. 140° eastward to Alaska, the Yukon and Mackenzie District at least as far as Coronation Gulf.

Siberia—Kamtschatka (MCZ, BM), Okhotsk (MCZ), Sredne-Kolynsk (RO), Awatsche Bay (RO), Petropavlovsk, Kuskan, Klutchi, Anaunas Valley—Kamtschatka (Nordström, 1928).

Alaska—Eagle (CNC, CAR), Alfred Creek Camp (AMNH), Circle City (PANS, MCZ), Kukak Bay (PANS, USNM), Ramparts (USNM, CAR).

Yukon—Dawson (CNC, MCZ, CAR).

Mackenzie District—North side of Smith Bay, Great Bear Lake (CNC), Dismal Creek and Coppermine River (Elwes—BM) (fig. 30).

Prof. Kusnezov writes: "The forms *viluiensis* and *mixturata* are very near each other and only formally distinguishable, occurring together in the same localities . . . . " He sends the following records for the Polar distribution of *tullia:* "Chibinä Mts. (Fridolin); Adjzva River, Petshora Basin (Zhuravskij—*isis* but near *mixturata);* Ganju River and the Pae-ör Range, Polar Ural (Fridolin—*viluiensis* and "fridolini," f.n. in litt: above brownish white grey, below pure whitish grey, white spots on the underside of the hind-wing diffuse . . . .); Olenek River (Czekanowski); Adytsha River (Bunge and Toll—*mixturata);* Jana River (Herz—*mixturata);* Verchojansk (several collectors—*viluiensis* and *mixturata);* Vilui River (Ménétriès, Christoph, Alpheraky, Herz —*viluiensis);* Witim River and Aldan River (Herz—*viluiensis* and *mixturata);* Lena River up to 64° (several collectors—*viluiensis);* Sredne-Kolynsk (Buturlin and others—*viluiensis* and *mixturata*). Ajan on the Okhotsk Sea (Grum-Grzhimailo); Shantar Islands (Dulkeit—*viluiensis* and *mixturata*) . . . . "

The series I have seen of *viluiensis* and *mixturata* listed above were quite distinct on a basis of size and color. However, Dr. Kusnezov's records seem to show that there is far less distinction between these subspecies than I had thought and that *mixturata,* indistinguishable from Kamtschatka specimens, ranges far to the west of the Lena along the shore of the Arctic Ocean.

The taxonomy of these polar forms can only be tentative.

Coenonympha tullia kodiak

Coenonympha kodiak Edwards, 1869, p. 375; Skinner, 1900, pp. 302–303, pl. V, figs. 1, 2; Dyar, 1902, p. 30; Weymer in Seitz, 1911, 5, p. 227; Holland, 1931, p. 182, pl. XXV, fig. 22.
Coenonympha kodiak Kirby, 1871, p. 100.
Coenonympha tiphon kodiak, Elwes, 1896, p. 230.

Original Description. "*Male.* Expands 1.5 inch. Upper side light brown with a grey shade, the whole surface having a silky gloss and appearing either brown or grey according to the point of view; a common whitish bar, caused by the transparency of the wings.

Beneath, from base to beyond middle of wings brown with grey scales on primaries and blue-grey on secondaries; this space edged by a common band of pure white; thence to margin pale brown with a whitish or bluish grey tint as viewed.

Body above brown; beneath, thorax covered with blue-grey hairs; palpi blue-grey; antennae annulated brown and white."

Type-locality. Kodiak Island, Alaska.

Specimens from Kodiak show a regular dark grey appearance with no ochre appearing above and below, and in this respect differ from eastern Asiatic and Alaskan mainland specimens. The female is slightly larger and lighter than the male. In color this insect is very like *viluiensis*, but the subspecies is uniformly larger.

Biology. Undescribed.

Range. Kodiak Island (PANS, USNM, CAR). (fig. 30).

Type. CAR. W. H. Edwards described this insect from *one* ♂ from the collection of Henry Edwards. The "type" specimen in the American Museum of Natural History (Hy. Edwards no. 228—AMNH no. 5718—labeled "collection Hy. Edwards" and recorded in Hy. Edwards' Catalogue in the possession of the Museum as being from Kodiak) is a ♀; furthermore the insect is lighter than any specimens I have seen from Kodiak and is almost certainly a mainland specimen. The specimen in the Carnegie Museum collection is the valid type.

Coenonympha tullia ampelos

Fig. 36

Coenonympha ampelos Edwards, 1871, p. 213; Skinner, 1900, pp. 303–305, pl. VII, figs. 7, 8, 9; Barnes and McDunnough, 1916, p. 71; McDunnough, 1928, p. 273; Holland, 1931, p. 184.
Coenonympha ampelos eunomia Field, 1937, pp. 249–250.

Coenonympha elko Edwards, 1880, pp. 57–58; Weymer in Seitz, 1911, 5, p. 226, pl. 50b; Holland, 1931, p. 184.

Coenonympha tiphon ampelos, Elwes, 1896, p. 230.

Coenonympha inornata insulana McDunnough, 1928, p. 273; Holland, 1931, p. 184.

Original Description. "Male—Expands 1.3 inch. Upper side bright, glossy ochraceous; immaculate; fringes concolored.

Under side nearly same shade, paler and changing to buff at apex of primaries; on secondaries slightly paler at outer angle and elsewhere much powdered with brown atoms; a pale straight ray from costal edge or primaries nearly crosses the wing; secondaries have a similar ray, tortuous, interrupted in the upper median interspaces, not quite reaching abdominal margin; both wings immaculate.

Body fuscous covered with ochraceous hairs; beneath yellowish and grey; palpi grey; antennae annulated black and white; club black, tip ferruginous.

Female—Same size, slightly paler; otherwise like male."

Type-locality. "Oregon."

Edwards' description of the upper surface does not adequately show its color relative to that of other subspecies. It is light—lighter than the color of the ♀♀ of *inornata* of eastern Canada.

Edwards says, following his description of *elko*: "The present species is nearly of same color with *C. ampelos* Edw. from Oregon; on upper side a little more yellow, and with less gloss. The under side is much lighter, and on secondaries the contrast between the dark basal area, with its clear cut outline and the pale yellow extra distal area is great . . . ."

Examination of long series of specimens shows one that the characteristics on the basis of which Edwards separated *elko* from *ampelos* are not regular.

There is a great range of variation between extremes found in cool damp regions and those found in warmer, dryer ones. Many spring specimens from Vancouver I., western Washington and western Oregon are very dark below and conform to the description of *insulana* McDunnough (1928). The secondaries and the apex of the primaries may be dusted over with gray green below; there seem generally to be no ocelli. At the same time, summer specimens from the same regions may hardly be distinguishable from the types of *elko* (CAR). In general it may be said that in series from warmer localities in southeastern Washington, eastern Oregon, northeastern California, Nevada and Utah the *elko* form seems dominant. But this is not regular. As an example we may cite the series in the United States National Museum from Plumas Co., Calif. In this series some are intermediate between

the two extremes of coloring and about fifty percent possess vague apical ocelli on the under side of the primaries and marginal rows of yellowish points on the secondaries. Part of the series taken in September is made up of both light "elko" and dark "insulana" forms.

I therefore see no reason to retain the names *elko* or *insulana.* Edwards raised this subspecies from Vancouver I. ("insulana") material and himself did not see fit to consider the adults obtained a distinct subspecies.

The range from "insulana" to "elko" over the range of the population is in the main seasonal; on the basis of the pale upper surface, the likeness of the sexes, and the general lack of ocellation I prefer to consider these extremes of one population. The name *ampelos* takes precedence.

Biology. Edwards, 1887, pp. 41–44.

Range. Southwestern British Columbia and Vancouver I., Washington, Oregon, northeastern California, western Idaho, Utah and Nevada. (fig. 30).

Types. CNC (see McDunnough, 1928).

Coenonympha tullia eryngii

Coenonympha eryngii Henry Edwards, 1876, p. 172.
Coenonympha california galactinus, Skinner, 1900, p. 302 (*partim*).
Coenonympha california eryngii, Barnes and McDunnough, 1916, p. 70; Comstock, 1925, p. 62; Holland, 1931, p. 182.
Coenonympha california siskiyouensis Comstock, 1925, pp. 62–63.

Type-locality Soda Springs, Siskiyou Co., California.

Marked and colored as *california* but without ocelli on primaries or secondaries. Seasonal forms the same.

Barnes and McDunnough (1916) say: " . . . . it is true that the number of spots on the underside of *Coenonympha* species is very variable and unspotted specimens doubtless occur in other localities, making the presence or absence of such spots a poor means of differentiation, but where the unspotted form has become more or less constant and has developed therefore into a race such a change should not in our opinion be disregarded."

Biology. Undescribed.

Range. From the region around Mt. Shasta into southern Oregon. (fig. 30).

Coenonympha tullia california

Fig. 37

Coenonympha california Westwood, 1851, p. 398, pl. LXVII, fig. 2; Weymer in Seitz, 1911, 5, p. 226, pl. 50 a, b; Barnes and McDunnough, 1916, p. 70; Comstock, 1927, pp. 65–66; Holland, 1931, p. 182.

Satyrus galactinus Boisduval, 1852, pp. 309–310.

Coenonympha ceres Butler, 1866, p. 78.

Coenonympha californicus, Edwards, 1886, p. 203.

Coenonympha tiphon californica, Elwes, 1896, p. 230.

Coenonympha californius, Edwards, 1897, p. 222.

Coenonympha galactinus, Edwards, 1897, pp. 219–223, figs. 1–9.

Coenonympha californica, Skinner, 1900, pp. 299–302, pl. VII, figs. 3–6; Dyar, 1902, p. 29.

Original Description. Plate.

Type-locality. "California."

A white upper surface is characteristic of this subspecies and the preceding and together they are the only strongly seasonally dimorphic forms of the Nearctic region.

The spring form is creamy below, the anterior part of the primaries more or less dusted over with gray. There is often a sinuous and varying postdiscal band and there may or may not be apical ocelli or points. The lower side of the secondaries is almost entirely dusted over with gray; the median band varies. There are from one to five submarginal ocelli.

The summer form is creamy above and in general gives a lighter appearance, since there is less dark marking to show through from below. The markings below are as in the spring form but are rusty rather than gray and may fade in some specimens almost to nothing. Some individuals from southern California (San Diego Co.) have a strong rusty tinge below.

Westwood's name, *california*, has priority over all and alone should stand. *Pulla* Hy. Edwards is aberrant.

Biology. Edwards, 1886, pp. 201–204; 1897, pp. 220–222, figs. a-g. Comstock, 1927, p. 66, fig. A27.

Range. Comstock says that this insect "is found in all parts of the state" (California) "except in the far northeastern sections, and possibly also the higher alpine regions and desert wastes." (fig. 30).

Type. BM.

Coenonympha tullia columbiana

Fig. 34.

Coenonympha inornata columbiana McDunnough, 1928, pp. 273–274; Holland, 1931, p. 183.

Original Description. " . . . . considerably larger and brighter colored than the Vancouver island one, the ♂ being about the same shade of deep ochre as the ♀ of typical *inornata* and the ♀ only slightly paler. The underside of the primaries is very bright ochre-brown, contrasting strongly in fresh specimens with the gray-green apical section which is without ocellus (in one ♀ I find a small ocellus) normally; the secondaries are paler than in *insulana* but still show more greenish color than in *ampelos*."

Type-locality. Aspen Grove, British Columbia.

This seems to form a transition between *ampelos* and *benjamini*, and it is a rather homogeneous isolated population. The ♂♂ are brighter than any specimens of the coast form and there is more difference between the sexes, the ♀♀ being larger and lighter than the ♂♂.

Biology. Undescribed.

Range. Southern interior of British Columbia. Aspen Grove, Olwen, Keremeos, Summerland, Vernon, Whitewater region north of Lillouet (CNC); Brookmere (MCG); Osoyoos (MCG, USNM). (fig. 30).

Type. CNC.

Coenonympha tullia benjamini

Fig. 34.

Genitalia (figs. 27, 28).

Coenonympha typhon inornata, Kirby, 1871, p. 100 (*partim*).

Coenonympha inornata, Scudder, 1889, III, p. 1781 (*partim*); Weymer in Seitz, 1911, 5, p. 227, pl. 50b (*partim*); Barnes and McDunnough, 1916, p. 70.

Coenonympha tiphon laidion, Skinner, 1900, pp. 306–307, pl. VII, figs. 10, 11 (*partim*).

Coenonympha inornata benjamini McDunnough, 1928, p. 272, Holland, 1931, p. 183, pl. LX, figs. 19, 20.

Original Description. "In contradistinction to the typical subspecies," (*inornata*) "however, this race has normally a well-developed ocellus on the under side of the primaries apically, consisting of a round black spot with pale center, surrounded by a ring of pale ochreous; specimens with reduced or even obsolete ocellus do occasionally occur but are distinctly the exception rather than the rule; other specimens show traces of a weak submarginal row of ocelli on the under side of the secondaries and very rarely there is a second

ocellus on the primaries. The underside of secondaries is somewhat deeper greenish and the basal half shows decidedly more brown tinges than in the type form whilst on the upper side the pale suffusion along the outer margin is practically absent." (McDunnough, 1928).

Type-locality. Waterton Lakes, Alberta.

On the average the upper surface of the males is brighter and slightly less suffused with gray than *inornata;* the males are only slightly darker than the females. Dr. McDunnough does not mention the submarginal row of brown lunules that appears on the lower side of the secondaries in some specimens. Specimens from Glacier Park, Montana and the Waterton Lakes region (types) seem to be brighter and more heavily dusted with gray-green than those from Saskatchewan and the Dakotas.

Biology. Undescribed.

Range. A plains race. Minnesota, the Dakotas, Montana, Manitoba, Saskatchewan, Alberta and eastern British Columbia. (fig. 30).

Type. CNC.

Coenonympha tullia inornata

Fig. 35.

Coenonympha inornata Edwards, 1861, p. 163; Scudder, 1889, III, p. 1781 (partim); Weymer in Seitz, 1911, 5, p. 227, pl. 50b (partim); McDunnough, 1928, p. 272; Holland, 1931, p. 183, pl. XXV, figs. 13, 29.

Coenonympha typhon laidion, Buckell, 1895, p. 107.

Coenonympha tiphon inornata, Elwes, 1896, p. 230.

Coenonympha tiphon laidion, Skinner, 1900, pp. 306–307 (partim).

Coenonympha inornata quebecensis Barnes and Benjamin, 1926, p. 89.

Original Description. "Male. Upper side ochre-brown, lighter in the disk of all the wings; costal margin of primaries and abdominal margin of secondaries greyish; no spots above or below; fringe grey, crossed by a darker line.

Under side; primaries same color as above from the base to beyond the middle; then a transverse sinuous ray of paler color, and beyond this to hind margin greyish; sometimes this ray disappears, the basal color extending nearly to the apex; secondaries grey with a slight greenish tinge, darker from base to middle, and this shade separated from the paler margin by a transverse, tortuous, interrupted ray, the course of which is parallel to the hind margin."

Type-locality. "Lake Winnipeg."

A certain percentage of specimens carry obsolescent ocelli or points at the apex of the primaries below. The females are generally less dusted with gray on both surfaces.

Specimens taken at Bradore Bay, P. Q. (CNC) seem slightly smaller

and more richly and brightly dusted with gray-green and olive. Newfoundland specimens are quite typical but in the southwestern part of the island merge into *mcisaaci* Dos Passos.

Range. From Labrador and Newfoundland west to Lake Winnipeg and north at least to Hudson Bay. McDunnough (1928) says: "*Inornata* is, therefore, a typical inhabitant of the spruce-belt section of the eastern half of Canada, apparently reaching its southern limits in the Algonquin Park region of Ontario and the lower reaches of the Gatineau River just north of Ottawa; it is found in a scarcely modified form in Newfoundland and extends northward at least as far as the southern shore of James Bay . . . . " (fig. 30).

Biology

During the summer of 1935 I took a short trip into southern Quebec and spent some weeks on Lake Nominingue, Co. Labelle. While there I became interested in trying to raise this insect, the life-history of which had not been described and which I suspected of being very close to those of *california* and *ampelos*, described by W. H. Edwards (1886, 1887).

I found the insect fairly common drifting about in its characteristic skipping and erratic manner over the damp and grassy low places dotted with alder and over the larger open meadows. After I had spent a few days collecting and getting oriented a hailstorm and high wind practically decimated most of the butterflies in the region. After the fifteenth of July I was able over a few days to collect about a half dozen frayed and battered females which I confined in a cage over lawn grass (Poa, Festuca, Agrostis sps.) and periodically put in the sun. From these I managed to collect fifteen eggs. Accident, mold and preserving each stage left one larva to survive the winter, and this luckily pupated successfully on April 29th, 1936.

It would seem that in reality the American forms of *tullia* are easy to raise. Confining enough females early in the season would give one a large supply of fertile eggs; I raised the larvae through to pupation in tightly stoppered glass jars which kept out dust and preserved the freshness of cut grass leaves for a couple of days. Growing grass would of course be better to use, but such small larvae are apt to be lost among the roots, and they should be easy to observe at all times. The young larvae may be kept individually in small glass vials with a few leaves of tender grass. A small water-soaked piece of cotton should be kept in the jars if one is working in a laboratory where desiccation may occur.

Egg. The eggs are singly attached to grass stems or leaves or the cage. They are about one millimeter high, shaped and sculptured as those described by Edwards for *california* and *ampelos,* and greenish-yellow when laid, later to become yellowish, threaded and streaked with red-brown. Approximately eight days for this stage.

Larva. (fig. 32, fourth larval instar). The new-born larva is flesh colored with a brown head. After eating it soon becomes the typical grass green color characteristic throughout larval life, but retains a brownish dorsal line and head. After the first molt the head is emerald and the body grass-green with a dorsal dark green line and two lateral stripes of green over a whitish-yellow basal ridge. The two caudal tails are pink and covered with tubercles. As in the larvae of *ampelos* and *california* the body and head are covered with fine, light tubercles set with hairs and the head capsule s finely granulated.

Chrysalis. (fig. 33). No better description of this stage can be given than that of Edwards for the chrysalis of *ampelos:*

" . . . . cylindrical, stout, the upper end truncated, the abdomen swollen, conical at extremity; head case narrow, ending in a sharp cross ridge which is a little arched, the sides slightly convex, followed by a shallow depression; color delicate green; marked by nine black stripes placed as in *galactinus*" (*california*) "of these, one on dorsal edge of each wing case from base to inner angle of wing;" (backed, in *inornata,* with white) "a curved stripe on middle of each wing reaching the hind margin; a short stripe on same margin on ventral side of the curved one; two short stripes on the antennae cases; besides these, there is a black mark on either side of 13;" (in *inornata* on the last three abdominal segments) "top of head case whitish."

Edwards neglects to mention the yellowish brown spiracles and also the "anal segment, which terminates in a knobbed cremaster, amply provided with a dense cluster of amber-coloured hooks" mentioned by Frohawk (1924) on the chrysalis of *tullia polydama.*

About one day before emergence the chrysalis becomes grayish and transparent so that the ochre wings and darker body parts are quite evident.

egg	*8 days*	*about 1 mm.*
1st instar	11–19 days	4 mm.
2nd. instar	14–27 days	6 mm.
3rd. instar	19–26 days	8 mm.
4th. instar	(hibernation, Sept.-April)	9 mm.
5th. instar	9 days	20 mm.
chrysalis	12 days	9 mm.

From the above it can be seen that there seems to be little regularity within limits to the time of each instar, certain individuals passing a longer time between molts than others. The months for hibernation are simply those months passed in the cold room (40° F.) in the laboratory; in nature the hibernation period is probably from seven to eight months. To be noted is the rapid growth after the last molt.

Comparison of the above with the life-histories of *tullia*, *california* and *ampelos* serves to present more evidence that these Nearctic forms are merely subspecies of one good species.

Coenonympha tullia nipisiquit

Coenonympha inornata nipisiquit McDunnough, 1939, p. 266.

Original description.. "Male. Characterized, as compared with typical *inornata* from the Quebec Laurentians and northern Ontario, by the deep brown color of the upper side shaded with smoky brown broadly along the outer margin of primaries and on nearly the whole of secondaries. The fringes are deep smoky, paling on the secondaries to gray below the apex of wing. Beneath, the primaries are deep brown shaded with greenish gray apically and narrowly along costa and down the outer margin toward anal angle; the irregular creamy oblique band is prominent and an apical ocellus may or may not be present; in the holo- and allotypes it is present, consisting of a circular black spot ringed with pale ochreous and with a central white dot. The basal portion of secondaries within the irregular pale band is shaded with brown and appears much deeper in color than in the typical form; the marginal area is suffused with greenish gray and shows traces (at times quite distinct) of a diffuse brown marginal band; the pale median banding is quite prominent and much as in *inornata*, varying considerably in individuals.

Female. Deeper ochre-brown in color than *inornata* and almost the same color as rather pale males of the typical form. Maculation otherwise as in male. Expanse 30 mm."

Type-locality. Bathurst, N. B.
Biology. Undescribed.
Range. Northeastern New Brunswick.
Types. CNC, MCZ (paratypes).

Coenonympha tullia mcisaaci

Fig. 35.

Coenonympha inornata mcisaaci Dos Passos, 1935, pp. 83–84.

Original Description. "♂ 34 mm. Primaries, upper side; disk ochraceous tawny; costal, outer and inner margin light brownish olive. Secondaries, light

brownish olive; inner margin, pale olive grey. Primaries, under side; basal area, sage green extending along costal margin but shading into tea green at apex; inner margin, ochraceous tawny, the division between the discal and limbal areas being marked by an irregular line, light brownish olive on the inner side and pale olive grey on the outer side; outer margin, pale olive grey. Secondaries, sage green at the base, tea green beyond the cell, which is outwardly defined by a pale olive grey angular mark, reappearing at the anal angle. Fringes of both wings on both sides, pale olive grey.

♀ ♀ 33 mm. Primaries, upper side cinnamon buff, darker at the base, the markings of the under side faintly showing through. Secondaries, clay color, but markings also showing through. Primaries, under side; similar to ♂ but paler, the band broader and more distinctly defined. Secondaries, similar to ♂. The mesial band, pale olive grey continuing almost to the anal angle. The upper and under sides of both wings are bounded by a faint narrow black line and are without ocelli. Fringes similar to ♂.

Antennae, head and body, similar to *inornata*."

Type-locality. Doyles Station, Newfoundland.

Mr. Dos Passos says: "The contrast between the sexes on the upper side is striking, more so than in any other species of the genus except *haydenii* Edwards." This form is very close to *inornata*, the main difference being the darkness of the males. In a series collected for me at the type locality in 1935 there were two with well marked apical ocelli.

Biology. Undescribed.

Range. So far this has only been taken in the vicinity of the type locality. (fig. 30).

Types. AMNH.

Coenonympha tullia ochracea

Fig. 38.

Coenonympha ochracea Edwards, 1861, p. 163; Skinner, 1900, pp. 305–306, pl. VII, figs. 12, 13, 14; Weymer in Seitz, 1911, 5. p. 226; Barnes and McDunnough, 1916, p. 72; Holland, 1931, p. 185.

Coenonympha brenda Edwards, 1869, pp. 375–376; Holland, 1931, p. 185; Chermock and Chermock, 1938, pp. 49–50.

Coenonympha tiphon inornata, Elwes, 1896, p. 230 (partim).

Original Description. "Male.—Upper side entirely of a bright, glossy ochre yellow, without any spot or mark, except what is caused by the transparency of the wings; base of both wings dark grey; abdominal margin of secondaries pale grey; fringe pale grey, crossed by a darker line.

Under side: primaries same color as above; costal margin, apex and base greyish; near the apex a round, sometimes rounded-oblong, black spot with

white pupil and pale yellow iris; this is preceded by an abbreviated, pale yellow, transverse ray.

Secondaries light reddish-brown, greyish along the hind margin; abdominal margin and base dark grey; near the hind margin and parallel to it is a series of six black dots, sometimes obsolete, usually with white pupil and broad yellow iris; near the base two irregular pale brown spots, and midway between the base and the hind margin a sinuous, interrupted ray of same color, extending nearly across the wing.

Female like the male."

Type-locality. See discussion below.

I have seen no specimens without at least obsolescent apical ocelli. Series from some localities such as the Yellowstone will show every variation in the size and number of submarginal ocelli and in the white markings forming the broken or continuous median band, but throughout its range this form is very constant in color above and in the likeness of the sexes.

A series of specimens before me from Jemez Springs, N. M., are all strongly ocellated and approach *furcae* Barnes and Benjamin from the Grand Canyon. Another series from St. Ignatius, Mont., show us that to the north this subspecies merges into *benjamini* McDunnough, which is found typically in Glacier Park. Many specimens from Colorado show a tendency towards suppression of the ocelli and the secondaries may be a dusty black below.

Biology. Undescribed.

Range. A Rocky Mountain form. Montana, Idaho, Wyoming, Colorado, Western Nebraska (Sioux Co.), and Kansas, Utah, northern New Mexico, and southern Nevada (Charleston Mts.—col. R. Chermock). (fig. 30). In Colorado it is not uncommon to find it as high as 12,000′. It is evidently commoner in Montana than the few specimens I have seen would indicate. Elrod (1906) reports it from the following localities: Missoula, New Chicago, Tobacco Root Range, Ruby Mts., Miles City, Forsyth, Bozeman, Mission Mts., Helena, Bear Paw Mts.

Type. In the Carnegie Museum may be seen two specimens of *inornata*, one male and one female, both labeled "type" and "Lake Winnipeg" in the hand of Edwards.

Also there is a female type specimen of *ochracea* labeled "Winnipeg".

All these specimens conform to Edwards' 1861 descriptions.

He describes *ochracea* from "Lake Winnipeg, California, Kansas", having already described *inornata* from Lake Winnipeg in the preceding paragraph. Strangely, however, Edwards' series in the Carnegie

collection labeled *ochracea* are nearly all labeled "Col." and "Colo." Furthermore, nothing has turned up that approaches his description from California. It is conceivable, as the Chermocks say (1938), that Edwards mistook the "Col." labels for "Cal." "Kansas" at the time Edwards wrote included most of the Rocky Mountain region from which we know his series came.

A careful examination of Edwards' description of *ochracea* will show one that it is an accurate description of the Rocky Mountain race; he stresses the strong row of ocelli and the similarity of males and females.

The female labeled "type" in the Edwards material conforms with the description, as has been said, but it is labeled "Lake Winnipeg". What do we know of Lake Winnipeg material? Does the Rocky Mountain race occur there?

To complicate matters a series of specimens from Lake Winnipeg in the possession of Mr. Frank Chermock of Pittsburgh, to whom and to whose brother, Mr. Ralph Chermock, I am much indebted for material and information on this problem, are good *benjamini.* Edwards' *inornata,* the types from Lake Winnipeg, conform with his description and resemble eastern Canadian specimens.

It is evident, therefore, that Lake Winnipeg lies in the region where the races *inornata* and *benjamini* meet and that both races may be found in its vicinity. This, however, does not settle the problem of the *ochracea* type from Lake Winnipeg.

It is probable that inasmuch as Edwards described *inornata* and *ochracea* in the same paper, he had the series together before him at the time. It seems probable that when describing his Rocky Mountain series, most of which we know are labeled "Colo.", he had in it one specimen which had been mistakenly labeled "Lake Winnipeg" or that he chose one of his Lake Winnipeg specimens as type that conformed to his concept of the Rocky Mountain race. It is not rare that individual specimens of both *inornata* and *benjamini* resemble *ochracea* at times.

Now because of the fact of this ambiguity of material the Chermocks have made an effort to straighten the tangle by considering *ochracea* merely an individual form of *inornata* that resembles the Rocky Mountain race and accepting the name *brenda* for that race. I feel that they are merely substituting one ambiguous case for another.

Barnes and McDunnough (1916) say: "*Brenda* Edw. described from some of Reakirt's material, ostensibly from Los Angeles, Calif., is a typical *ochracea* as a study of the types in the Strecker Collections has shown us; the locality was very possibly erroneous as we know of no

authentic records for *ochracea* from this region; . . . . " Since the above was written nothing that resembles *ochracea* has turned up in California.

We therefore have no type locality for *brenda*. The specimens in the Field Museum—the Strecker types—seem to be the well-ocellated *ochracea* that occur with the typical in southwestern Colorado and southern Utah. It would seem that Edwards thought them distinct enough from the typical *ochracea* to warrant naming, whereas longer series show it to be simply a form.

I believe, therefore, that the name *ochracea* should stand for the mountain race; I also question the validity of the ♀ type in the Carnegie Museum.

Coenonympha tullia mackenziei

Fig. 38.

Coenonympha ochracea, Cary, 1907, p. 448.

Coenonympha tiphon mackenziei Davenport, 1936, p. 79.

Original Description. "Above brighter ochre than any American form except *subfusca* Barnes and Benjamin, from Arizona. The entire upper surface is a tawny ochre that in some males is dusted with grey near the margins. The fringes are nearly white and contrast sharply. Under side of the primaries lighter ochre, crossed by a very distinct, long postdiscal band of white; the margins are washed with grey-white. Lower surface of the secondaries grey or brown dusted over with greyish-white and crossed by an irregular median band of white that in some specimens sends projections into the basal area. Apical ocelli on the primaries and sub-marginal ones on the secondaries are strong, obsolescent or not present at all.

The females are similar to the males." (Davenport, 1936).

Type-locality. Nyarling River, Mackenzie Dist.

This is very close to certain individuals of *ochracea* from Wyoming and Colorado but is brighter on the upper surface and has strongly contrasting white fringes. I have seen no true *ochracea* Edwards from further north than Montana, and *mackenziei* seems to be cut off from its southern relative by the very distinct plains race *benjamini* McDunnough.

Biology. Undescribed.

Range. The vicinity of Great Slave Lake. Nyarling River, Mackenzie Dist. (CNC); Fort Providence, Mackenzie Dist. (USNM) (fig. 30).

Types. CNC.

Coenonympha tullia subfusca

Fig. 37.

Coenonympha ochracea subfusca Barnes and Benjamin, 1926, p. 90.

Original Description. "Much like *ochracea* on upper side. Underside of secondaries and apex of primaries heavily powdered with black, hind wing with ocelli as in *ochracea*, median band somewhat reduced, basal pale spots absent."

Type-locality. White Mts., Arizona.

This form is considerably brighter above than *ochracea* and the markings show through from below. Some individuals possess a second ocellus near the anal angle of the primaries below. In the types the apex of the primaries and the secondaries are dusted over with blackish. Topotypes in the Cornell University Collection are lighter, the dusting being grey-green and the median band on the secondaries strong. I have no doubt that long series would show as much variation as does *ochracea*. The sexes are alike.

Biology. Undescribed.

Range. Apparently this has only been taken in the type-locality. (fig. 30).

Types. USNM.

Coenonympha tullia furcae

Fig. 37.

Coenonympha furcae Barnes and Benjamin, 1926, p. 90; Holland, 1931, p. 185.

Original Description. "Sexes similar. The ground color is luteous, tinted with pale ochraceous, the markings of the underside showing through; underside with the maculations variable, similar to *ochracea;* fore wing with ground color similar to upper side, with a tendency toward the development of auxilliary ocelli; hind wing with ground color luteous white heavily powdered with fuscous, six ocelli, some obsolescent, present. The single male has the ocelli of the hind wing so reduced that they appear as pale blotches except for a few black scales in one blotch at tornus. The ocelli of the hind wing of the female range from two to six."

Type-locality. Grand Canyon, Arizona.

Biology. Undescribed.

Range. Known only from the vicinity of the Grand Canyon. (fig. 30).

Types. USNM.

[COENONYMPHA PAMPHILOIDES]

Coenonympha pamphiloides Reakirt, 1866, p. 146; Weymer in Seitz, 1911, 5, p. 227; Holland, 1931, p. 185.
Coenonympha pamphilus, Skinner, 1900, p. 308.

Holland (1931) says: ". . . it has been generally agreed that Reakirt, misled by a wrong locality-label, redescribed the European *pamphilus* L. under the name *pamphiloides*. In reality, there is no such species as *pamphiloides* in North America, and the name *pamphiloides* is a mere synonym for the European *pamphilus* which also does not occur in America."

The specimens Skinner (1900) figured are in Philadelphia and are typical *pamphilus* of central Europe. Through some error the label "Cal." has been attached to them; as Holland says, this species has never been collected in the Nearctic region.

Notes on the North American Forms

I cannot assign a more important place in the evolution and phylogeny of the genus to the American forms (with the exception of *haydenii*) than that of being subspecies of the widespread holarctic **tuilia**. The British entomologists, Elwes and Buckell, reached this conclusion in the past. The New World is poor in *Coenonympha* as there are only two species, one a very local, isolated one with no subspecies known, and another with about as many subspecies as it has in the Old World (see map—fig. 30).

In the eastern part of the North American continent, generally between about 55° and 95° West and between about 44° and 52° North occurs *tullia inornata* Edw. It is very close indeed in appearance to the subspecies of *tullia* from the British Isles and northern Europe and particularly to *tullia suevica* of middle Scandinavia and the Baltic region.

I cannot believe that at any time in the past the distribution of *tullia* was continuous between North America and Europe across what is now the North Atlantic, nor can I believe that they were carried in some way from one land mass to the other. One immediately thinks of parallelism or convergence in color development. I would advance another possible explanation. This is based on my belief that color characters on the basis of which I have separated these populations are constant and cannot be changed except by some method of selection acting over long periods of time.

One of the foundations of Matthew's theories of dispersal in his classic "Climate and Evolution" (1915) is that at the edges of the area

of dispersal of a group of related animals one finds the most primitive forms. At the center where evolution has had a longer time to work the animals have had longer to change, and pressure keeps them expanding out over their area in successive waves.

Would it not be possible to consider that the early *tullia* resembled *inornata-suevica,* that it may have spread from a center in Central Asia towards its present limits, western Europe and eastern North America, and that successive changes have occurred in the stock at and near the central area to bring about specialization and development of new forms? The fact that *tullia* has successfully colonized two worlds, as well as its seeming ability to subsist on a variety of species of grass in a variety of environments leads me to believe that its rate of dispersal was high.

Matthew, of course, does not nearly descend to the species or subspecies to illustrate this theory of relationships. He has the only real case for the theory, for he illustrates it with facts from his fund of knowledge of the distribution and phylogeny of the mammals both from living forms and from the fossil record.

But why can we not generally apply his theories to lower categories in the Invertebrata, when we can, as must be admitted, apply them to the races of Man, particularly if we believe that the characters on the basis of which we separate these subspecies are constant ones?

Immediately it will be said: "Then why are some forms, equally far from the dispersal center as *inornata* or *suevica,* such as *california* or *furcae,* so distinct from what you call the primitive type?"

Possibly the sum of the factors making up the environments of *inornata* and *suevica* is very close to that of the area from which the original stock came. The primitive form may have been allowed to remain unchanged though it be leagues from the dispersal center. In a very real sense it has been isolated from succeeding waves of development by being best adapted to the original type of environment. Long time and the selective action of many new factors have, however, changed the characteristics of certain subspecies lying on the periphery of the area of dispersal as do the southwestern forms mentioned above.

At any rate it would seem that *tullia* spread from one continent to the other via the Bering Strait connection, at what time and in which direction it is impossible to tell. The probability is, however, that it spread from west to east, inasmuch as there are a number of species of *Coenonympha* in the Old World. The present link is through *tullia mixturata* Alph., common to Siberia, Alaska and the Yukon region. It is perfectly possible to think of the species spreading from America to

Asia. *Coenonympha* may not be more recent in America than in Eurasia; the presence of *haydenii* in the Yellowstone, to be discussed later, is an enigma (see p. 328).

As for the rest of the subspecies of *tullia* in America, there has been time for the development of distinct forms in certain regions. *Furcae* and *subfusca* are merely isolated relatives of *ochracea; california* and *eryngii* seem fairly distinct; *ampelos, columbiana, benjamini* and *inornata* form another complex. Some specimens of *mixturata* from the Yukon region are very close to *ampelos;* more collecting in that wildest part of our continent back of the coast ranges in northeastern British Columbia might give us a completed chain between the two. *Mackenziei* from the vicinity of Great Slave Lake is almost indistinguishable from the true *ochracea* of the American Rockies and is distinct from *benjamini,* the plains race to the immediate south. The distribution of the ancestral *ochracea* must have once been from about 62° North nearly as far south as the Mexican border. The invasion or development of a new type, possibly to be correlated with the recession of the ice, has broken this stock in two parts.

Coenonympha amyntas amyntas

Androconia—figs. 8, 9

Papilio amyntas Poda, 1761, p. 79.
Papilio iphis Schiffermueller, 1776, p. 321.
Papilio tiphon, Esper, 1779, 1, pp. 341–342.
Papilio glycerion Borkhausen, 1788, 1, p. 90.
Papilio hero, Fabricius, 1793, p. 222.
Papilio manto von Schrank, 1801, 1, p. 181.
Coenonympha iphis, Hübner, (1823), p. 65; Tutt, 1896a, pp. xlii-xlvii; 1896b, pp. 256–258; Rebel, 1904, pp. 173–174; Seitz, 1908, 1, p. 144, pl. 48c; Oberthür, 1910, 4, pp. 15–18. (etc.)
Satyrus iphis, Godart, 1823, pp. 545–546.
Coenonympha mandane Kirby, 1862, p. 65.

Original Description. "P.P. alis integerrimis flavis limbo fusco, subtus striga repanda argentea submarginali: primoribus ocello unico, posticis sex. Alae primores supra subocello uno, in posticis ocelli 1.4.5. reliquis minores."

Type-locality. Unknown.

Average 33 mm. The males are dark brown above with a tinge of ochre at times on the inner half of the primaries. Primaries below lighter ochre-brown, the apex and part of the outer margin obscured with grey. Some males possess a very vague apical point. The under side of the secondaries is grey-brown to slate grey with slaty-grey hairs

at the base. There is an ochre marginal line backed by a metallic line; in some specimens these are almost or completely obsolete. The ocelli are small, vary in size and in number from two to six. There is every stage of variation in the postdiscal white marking between a mere trace and a strong irregular band.

Above on the primaries the females are light yellowish-ochre, the outer margins obscured with grey and limited by a light ochre line. The secondaries are dark grey edged with ochre and at times with traces of the ocelli showing through from below. On the underside they are marked as the males but are lighter and more often possess apical points; there is also less tendency towards loss of ocelli on the secondaries.

There is considerable difference of opinion as to which name, *amyntas* or *iphis*, should be retained. Authors have made the former synonymous with the latter, which is, of course, impossible inasmuch as the former has priority. The objection to *amyntas* has been that the insect to which Poda applies the name is too poorly described for one to be sure of its identity. It is inadequately described, quite obviously, but there seems to be no other insect to which this description can apply. Poda stresses the metallic line and the fact that ocelli 1, 4, and 5 are larger than the rest, which is generally true in this form. The only other possible insect to which his description could apply is *arcania*, and the fact that he does not mention the wide white band so noticeable in *arcania* removes this possibility. Poda's description applies to the female.

Unfortunately I have been unable to examine Tutt's (1896) series from the Dauphiny Alps, in which he claims he has complete transition between this species and *gardetta* (=*satyrion*). Although Tutt might possibly have found a locality in which the two species were actively hybridizing in a zone of overlap, this does not seem very probable; it is significant that Tutt nowhere mentions any disparity in size between the end forms of his series, and in this respect there seems to be a regular difference between *amyntas* and *gardetta*.

In southeastern Europe occur some males that are darker than usual; the colors seem at times brighter. However, the characters on the basis of which the following have been separated are nowhere regular and the names are not worthy of retention:

anaxagoras Assmus.
exommatica Rebel.
iphicleoides Schawerda.
herthae Stauder.

Biology. Hübner, (1796)—(1841), Papiliones, I; Nymphales F.C. 2 a.b.; Treitschke, 1834, p. 56; Freyer, 1833–1858, 7, pl. 606; Wilde, 1861, pp. 37–38; Hofmann, 1893, p. 23, pl. 5, fig. 15; Gillmer, 1900b, p. 351.

Range. The Pyrenees-Orientales, and from eastern France eastward across Europe and into Asia. The insect does not occur in the British Isles or Belgium and in Scandinavia appears only in southernmost Finland (Helsingfors, Sanosaari—RO). Apparently it reaches its southernmost limit in the Balkans and Armenia (Kasikoparan, Chivalinsk—BM), and for its northern limits in the USSR Dr. Kusnezov sends me "Vjatka and Vologda (Krulikovskij); Olonetz (Gunther); Perm (Holtzermann)." For the typical in Asia he sends: "Omsk and Tomsk (Meinhardt, Vnukovskij)."

Coenonympha amyntas bertolis

Papilio bertolis de Prunner, 1798, p. 75.

Coenonympha iphis anaxarete Frühstorfer, 1910b, p. 3; Gaede in Seitz, 1930, (Supplement), 1, p. 175.

Coenonympha iphis belisaria Oberthür, 1910, 4, p. 17.

?*Coenonympha iphis carpathica* Hormuzaki, 1897, pp. 162–163.

?*Coenonympha iphis alta* Sheljuzhko, 1937, pp. 352–353.

Original Description. "Alis, intus fusce-flavis: extus, primoribus flavis, margine grisea; posterioribus griseis, duobus albis triangularibus maculis."

Type-locality. Casteldelfino in the Varaita Valley of Piedmont.

Larger than the typical, averaging about 33 mm. Male above as the typical female slightly darker. Below, this subspecies is characterized by the fact that the ocellation is generally totally absent or may only appear very reduced. On the secondaries the postdiscal white marks vary in size, and the outer margins are often dusted with lighter grey.

De Prunner's description quite obviously applies to this unocellated form. There is therefore no reason to retain the names *anaxarete* or *belisaria*.

Biology. Undescribed.

Range. Hautes-Alpes (OB); Basses-Alpes (BM, BER); Alpes-Maritimes (MCZ, BM, BER); Alps of Piedmont.

Unfortunately I have seen no specimens of the small, lighter unocellated form *carpathica* Hormuzaki (1897) from higher altitudes in the mountains of Bukowina and can say nothing regarding the regularity of its characteristics or its status. *Amyntas* from Achalzich in Transcaucasia (BER) shows much reduction of ocellation, as do, ac-

cording to Sheljuzhko's description, specimens of his *iphis alta* from the Chatipara Mts. of the north Caucasus (Sheljuzhko, 1937, pp. 352–353).

Coenonympha amyntas iphina

Coenonympha iphis iphina Staudinger, 1892b, p. 339; Seitz, 1908, 1, p. 144.

Original Description. "Die früher von mir (Stettin. Ent. Zeit. 1881, p. 273) erwähnten variirenden Coen. Iphis vom Tarbagatai bilden einen Uebergang zur var. Iphicles, da die Augenflecken auf der etwas weniger grauen Unterseite der Htfl. braun statt galb umrandet sind. Die Augenflecken sind nicht kleiner als die von europäischen Iphis (wie ich früher aus Versehen angab), bei einem ♂ sind sie sogar etwas grösser und so breit schwarz gerandet wie häufig bei Iphis. Da die ♂♂ vom Tarbagatai auf der Oberseite auch (meist) lichter als typische Iphis sind, so kann die Tarbagatai-Form vielleicht als var. Iphina mit eigenem Namen bezeichnet werden. Durch die braun statt fahlgelb umrandeten Augenflecken unterscheidet sie sich sofort von Iphis; von var. Iphicles unterscheidet sie sich durch die weit von einander getrennten Augenflecken, deren noch intensiver braune Umrandungen bei var. Iphicles bindenartig zusammenfliesen."

Type-locality. ". . . vom Tarbagatai . . ."

This population is close to *amyntas* and makes the transition to *iphicles;* it seems quite regular, however, in the above characteristics.

Biology. Undescribed.

Range. The Tarbagatai Mts. (STB).

Types. STB.

Coenonympha amyntas iphicles

Coenonympha iphis iphicles Staudinger, 1892b, p. 338; Elwes, 1899, p. 362; Seitz, 1908, 1, p. 144, pl. 48c. (etc.).

Coenonympha iphis heroides Christoph, 1893, p. 87; Herz, 1898, pp. 248–249.

Original Description. "Die Grösse dieser var. Iphicles, wie ich sie nenne, ist wie die der Stammart, die Stücke sind 27–31 mm. gross. Die ♂♂ sind auf der Oberseite lichter bräunlich, fast wie die ♀♀, sie führen alle 3-5 Augenflecken vor dem Aussenrande der Htfl.; bei europäischen Iphis treten solche sehr selten auf; ein ♂ hat sogar 2 lichte blinde Augenfleckchen im oberen Aussenrandstheil der Vdfl. Bei 2 ♀♀ sind die Vdfl. kaum lichter als beim ♂, diese beiden führen einen schwarz gekernten, lichteren Apical-Augenfleck der den anderen beiden lichteren ♀♀ fehlt. Die Unterseite der Htfl. ist bei var. Iphicles weniger grüngrau, im Borderrandstheil ist sie meist vorherrschend bräunlich, besonders sind hier aber die meist grösseren schwarzen, silbern gekernten Randaugen breit braun umsäumt, so dass sie fast in einer braunen Binde zu stehen scheinen. Hinter ihnen steht eine weit breitere silberne Querlinie, diese ist wieder nach aussen von einer ebenso breiten braunen

Querlinie begrenzt. Bei Iphis sind die meist weit kleineren (zuweilen ganz fehlenden) Randaugenflecken schmal fahlgelb umzogen, sie sind meist weit getrennt. Vor ihnen stehen 2 unregelmässige weisse Flecken sowohl bei Iphis wie bei var. Iphicles. Die Unterseite der Vdfl. ist bei var. Iphicles ein wenig lichter braun, im Apex schr gering grau angeflogen, hier steht auch oft beim ♂ ein weissgekernnter Augenfleck. Ein verloschener, lichterer (weisslicher) bindenartiger Strich vor demselben tritt nur bei den ♀ ♀ schwach auf. Ein ♂ von Minusinska (sudöstliches Sibirien) stimmt fast ganz mit dieser var. Iphicles uberein, es ist auf der Unterseite der Htfl. ein wenig grauer, die Augenflecken sind nicht ganz so breit braun umrandet."

Type-locality. Kentei Mts.

Witim and Wilui specimens are not distinct, and the name *heroides* is therefore an absolute synonym of *iphicles.*

Biology. Undescribed.

Range. Asia north of the Gobi deserts from Long. 80° eastward to the Pacific, generally between Lat. 45° and Lat. 55°; also the Lena system to the Arctic Circle (Kusnezov), and far to the southeast, the Kukunor region, Kansu and Szechuan.

Semipalatinsk (MCZ); Kentei (MCZ, BM, STB); Bashkaus, Tchuja Valley, Ongodai, Arasan—Altai, 4000′-6000′ (Elwes—BM); Changai Mts. (BM, STB); Minnusinsk (RO); Sajan Mts. (MCZ, CAR, BER); Schawyr (STB, MUN); Tunkinsk (MCZ, CAR); Troizkossovsk (MCZ); Irkutsk (BM); Urga (STB); Jakutsk (BM); Wilui and Witim Rivers (BER, STB); Aldan and Lena Rivers (Kusnezov); Chingan Mts. (RO); "Amur" (BM); "Kukunor" (BER); Sining, Kansu (BM, STB); Chone, Szechuan (CAR).

Types. STB.

Coenonympha amyntas pearsoni

Androconia—fig. 10.

Coenonympha iphioides pearsoni Romei, 1927, p. 137.
Coenonympha leander pearsoni, Gaede in Seitz, 1930, (Supplement), 1, p. 175.
Coenonympha iphioides pseudoamyntas de Sagarra, 1932, p. 113.

Original Description. "*Pearsoni* is always much smaller than nymotypical *iphioides;* the whole underside is thickly suffused with brown scaling, the yellow ring around the ocelli is thinner, the silver line on the underside of the hind-wings, which is well marked in Castilian specimens is either faint or missing in Aragon. The ocelli of the underside of the hindwings are not so regularly disposed as in nymotypical *iphioides;* they are set almost as in *amynthus*, Poda (1761) = iphis, S.V. (1775)."

Type-locality. "Sierra Alta above Orihuela del Tremedal (Aragon)."

Average 32 mm. Ground color of males above as in *amyntas* with strong ochre-brown shading on inner half of the primaries and with a line of the same color appearing at the posterior margin of the secondaries. Primaries below are the color of the typical, apex dusted with ashy-grey and usually possessing an ocellus. Secondaries below ashy brown-grey with six ocelli, there being only a trace of the white marking, consisting of a small triangular mark capping the third ocellus, as in *iphioides*.

Females above as the typical but darker, below as the males.

Catalonian specimens were described by de Sagarra as making the transition between *amyntas* and *iphioides*, and they are hardly distinguishable from *pearsoni*.

Biology. Undescribed.

Range. Catalonia and Aragon. Nuria, Catalonia (BER); Mt. Taga, Catalonia (USNM); Orihuela, Aragon (MCZ, PANS, BM, RO).

Co-types. MCZ, PANS, BM, RO.

Coenonympha amyntas iphioides

Androconia—figs. 11, 12.

Coenonympha iphis iphioides Staudinger, 1870a, pp. 101–102.

Coenonympha iphioides, Oberthür, 1910, 4, pp. 18–19; Muschamp, 1915, p. 12. (etc.).

Coenonympha leander iphioides, Seitz, 1908, 1, p. 143, pl. 48c.

Original Description. "Das Thier ist etwas grösser als die *Iphis* gewöhnlich sind, etwa so gross als *C. Leander* Esp., dem es sogar sehr ähnlich sieht. Die Oberseite der Flügel unterscheidet sich wenig von *Iphis;* bei der ♀ der *Iphioides* findet sich eine sehr deutlich ausgeprägte schwarze Aussenrandbinde, von den dunklen Franzen durch eine scharfe helle Linie getrennt, wie so deutlich ausgeprägt bei *Iphis* niemals vorkommt. Das eine aberrirende Männchen zeigt nicht nur auf den Hinterflügeln vier deutliche Augenflecke, sondern auch auf den Hinterflügeln fünf Augenpunkte, die unten viel stärker auftreten. Die Hauptauszeichnung der *Iphioides* liegt nun auf der Unterseite der Hinterflügel. Hier treten zunächst die sechs Augenflecke ausserordentlich gross, schwarz, mit verhältnissmässig kleinem weissem Mittelpunkt auf, so dass sich die gelben Umrandungen meistens berühren. Wahrend ferner normale *Iphis* stets hinter der Augenreihe, nach innen zu, zwei weisse Flecke zeigen, einen grösseren oberen und einen kleineren unteren (die sich zuweilen gar bindenförmig vereinen), ist bei *Iphioides* nur von dem grösseren oberen eine Spur (in Zelle 4) geblieben, der untere fehlt ganz. Dieser bleibende kleine Fleck, der bei dem einen ♂ fast verschwindet, berührt immer die gelbe Umrandung des

dritten Auges, von oben an gerechnet. Bei manchen Stücken (namentlich alpinen) von Iphis ist nun auch nur der obere weisse Fleck, oft sehr klein, vorhanden, berührt dann aber nie das Auge, und sind diese meist kleinen Stücke besonders durch das folgende Hauptmoment von Iphioides ganz verschienden. Iphioides hat hinter einer sehr scharfen dunklen, von den lichten Franzen sehr abstechenden Limballinie ein auffallend breites ockergelbes Band, das nach innen von der deutlich breiten Bleilinie begrenzt wird. Dies gelbe Aussenband findet sich bei den meisten *Iphis* auch vor, aber viel schmäler, weniger hervortretend. Bei *C. Leander* liegt dies ockergelbe Band hinter der Bleilinie. Auf den Vorderflügeln findet sich bei meinen vorliegenden drei Pärchen keine Spur einer Bleilinie, die sich bei gewohnlichen *Iphis* nicht gar selten auch hier zeigt, was insofern auffällig erscheinen muss, als bei *Iphioides* diese Bleilinie auf den Hinterflügeln starker als bei *Iphis* auftritt."

Type-locality. ". . . bei St. Ildefonso in Alt-Castilien." Average 35 mm. Marked above and below as *pearsoni*, but richer and brighter, the lower side of the secondaries not as ashy. This is the largest of the chain of subspecies of *amyntas.*

That Staudinger was correct in making this a subspecies of *amyntas* the subsequent discovery of the transition, *pearsoni*, has shown, as well as the chain of androconial development from *amyntas* (figs. 8–11). Seitz considers it a *leander*-subspecies solely on the basis of the superficial resemblance of the upper surface. Muschamp (1915) considers *iphioides* the Iberian *tullia* (!), because it also is a local swamp-inhabitor.

Biology. Undescribed.

Range. Local in Spain. Nueva Castilla, Cuenca (MCZ, USNM, PANS, RO, WIEN); Madrid (CAR); Albarracin (BM, RO, WIEN); Picos de Europa, Asturias (BM, WIEN); Branuelas (BM); La Granja (BM); St. Ildefonso, Segovia (RO, STB); Hoyos (WIEN).

Types. STB.

Coenonympha mahometana

Coenonympha iphis mahometana Alpheraky, 1881, pp. 428–429; Seitz, 1908, 1, p. 144, pl. 48d. (etc.).

Coenonympha mahometana, Wagner, 1913, pp. 189–190, fig. 15.

Original Description. "Les iphis du Tian-Chian, que nous trouvâmes, entre 4000 at 7000′ d'altitude, le long du Kounguesse, en Juin et Juillet, constituent une race bien constante.

Elle diffère du type: En dessus, par la couleur du fond des ailes d'un brun-noirâtre; en dessous, par un gris-brunâtre, qui remplace le fauve du type.

À la place des points ocellés du type, nous ne trouvons, dans cette varieté,

que de simples points d'un blanc sale, (ou jaunâtre), centrés de blanc pur, (argenté), chez les ♀ ♀ seulement.

Les ♀ ♀ seules, possèdent la série complête de ces points.

La partie basilaire des ailes posterieures est hirsée, endessous, de poils gris-verdâtre comme chez le type. La raie couleur de plomb et la raie marginale ocracée (ou ferrugineuse) ne sont indiquées que sur quelques individus, ♀ ♀ pour la plupart.

La bande blanche n'est jamais continue: elle est indiquée seulement par deux ou trois taches blanches, ce qui du reste a souvent lieu chez le type d'Europe. Les antérieures sont traversées sur le revers, au deux tiers de leur longueur, par une série effacée de taches blanchâtres."

Type-locality. ". . . entre 4000 et 7000′ d'altitude, le long du Kounguesse." (Tian Shan).

♂♂ average 31 mm., females slightly larger.

With Wagner (1913) I agree that this insect had best be considered a species distinct from *amyntas*, inasmuch as no intermediate transition specimens have ever been taken.

Biology. Undescribed.

Range. Central Asia from the southern Altai southwestward to Russian Turkestan.

Kuldja Dist. (MCZ, STB); Tekkes (CAR); Ft. Naryn, Semiretchensk (OB); Kenduht—S. Altai, Alexander Mts., Koksu Mts., Agrass, Muzart Valley—Tian-Shan Range, Kashgar (BM); Little Kizil-su, Turgan-Aksu Pass and Sirt Sary Pass—Tian-Shan Range, Kappak, Alexander Mts., Bir-Bash and Kok-tjube, Issyk-Kul (RO); "Ili" (BER, MUN); Wernyz, Turkestan (STB); "Issyk-Kul" (STB, MUN); Varunsk, Turkestan (DR); Dzarhkent (MUN).

There is a single specimen in the British Museum labelled "Khardong—near Leh"; the species may, therefore, range as far south as the Karakorum.

Coenonympha sunbecca

Hipparchia sunbecca Eversmann, 1843, pp. 538–539, pl. VII, figs. 4a, 4b.

Coenonympha sunbecca, Herrich-Schaeffer, 1851, 1, pl. 126, figs. 611, 612; Alpheraky, 1881, p. 430; Staudinger, 1881, p. 300; Grum-Grzhimailo in Romanoff, 1890, 4, p. 498; Heyne in Ruhl, 1894, pp. 623–624; Seitz, 1908, 1, p. 147, pl. 48h, i; Wagner, 1913, pp. 188–190, 244–245, fig. 15.

Coenonympha sunbecca alexandra Heyne in Ruhl, 1894, p. 624.

Original Description. "Alae supra albidae, signaturis paginae inferioris transparentibus;—subtus anticae albidae, ad costam et apice nigricantes, ocellis apicis, tribus albidis coecis; posticae olivaceo-nigricantes, maculis basali-

bus subatribus, serie macularum sex externa ocellisque quinque coecis albis. (Mas).

Eadem statura et colore, quo Hipp. Phryne fem., sed major. Supra vix e flavescenti albida, vel sincere alba, una cum ciliis concolor, color autem paginae inferioris obscurus transparet, praecipue in alis posticis. Ocelli paginae inferioris omnes sunt coeci, i.e. maculae rotundae albidae: earum sunt in alis anticis tres apicales, singulae inter binos nervos positae; in posticis autem ubique juxta marginem externum inter binos nervos macula rotunda locata est; post eas reperimus seriem macularum albarum, quarum singulae inter binos nervos positae; praeterea videmus ad basis tres maculas albas: majorem juxta marginem anticum, alteram ad discum amotam et tertiam inter eas minore. (Femina latet.)."

Type-locality. Noor-Saisan.

This is a very variable species. Its size ranges from 29 to 36 mm., the females generally larger than the males. There is much variation in the amount of grey below, from individuals that have the whole lower surface obscured except for the maculation to individuals with the grey much reduced. *Alexandra* is simply the darkest variation and flies with the typical.

Biology. Undescribed.

Range. Through the Tian-Shan Range of Central Asia, ranging up to 14,000′, from the Borochoro Mts. west and south at least as far as the Serafschan Mts.

Naryn River (MCZ); Kuldja Distr. (MCZ, BM, STB); Aksu, Sinkiang (MCZ); Aksu Valley (MCZ, STB); Docharken (MCZ); Tekkes (MCZ, CAR, RO); Fort Naryn, Semiretchensk (OB); Alai Range (OB, BM, STB, MUN); Alexander Mts. (BM, BER, STB); Borochoro Mts. (BM); Ala-tau Mts. (BM, STB); Pamir (BM); Kashgar (BM); Sussamyr Mts. (RO); "Issyk-Kul" (BER, MUN); Usgent, Namangan (STB); Serafschan Mts. (STB).

[Status of Coenonympha decolorata]

Coenonympha decolorata Wagner, 1913, pp. 189–190, fig. 15; Gaede in Seitz, 1930, (Supplement), 1, p. 179, pl. 11g.

Original Description. "Von der Grösse der *Sunbecca* Ev. Oberseite ein schwer definierbares, im Saumfelde der Vorderflügel und auf den Hinterflügeln etwas dunkleres, schmutziges Bräunlichweiss, mit von unten durch-schlagenden Zeichnungen. Vor den nahezu reinweissen Fransen zieht ein sich deutlich abhebende dunkle Limballinie. Vorderflügelunterseite annähernd von der Farbe der Oberseite, am Costalrand und vor dem Saume breit dunkler. Zwei der vorliegenden Stücke besitzen unterseits ein winziges Apicalauge sowie eine

Reihe verloschener hellerer Flecken im Saumdrittel. Hinterflügelunterseite bräunlichgrau, im wurzelfeld mit ziemlich langen, grünlichen Härchen, einer Reihe schwach oder nicht gekernter weisser Ozellen im Saumfeld und ebensolcher Fleckenbinde davor. An Stelle der Bleilinie ein schmutzigweisse Linie um den Analwinkel. Einem Stück fehlen auf der Hinterflügelunterseite fast samtliche Ozellen und auch von der Fleckenbinde sind nur noch Uberreste vorhanden (vide Abbildung)."

Type-locality. "Schlucht Burchan . . . Iligebiet."

I am in considerable doubt as to the status of this form but am rather certain that it should not be considered a distinct species. Specimens in the Berlin Museum (ex Wagner) seem to be very close to *sunbecca* but darker above and below. They are not nearly as dark as Wagner's figure would show but are in reality a dirty grey-white above as shown in Seitz. The form may simply be an extreme variation in the very variable *sunbecca,* even darker than the form *alexandra* which appears in many localities with the typical. However, the fact that it flies with both *sunbecca* and *mahometana* and the likeness of its lower surface to both of these insects would lead me to believe that it is an irregularly occurring hybrid. Gaede compares it with *semenovi,* with which certainly neither it nor *sunbecca* have any affinity.

Range. "Ili" (BER); Tian-Shan (STB).

Co-type. BER.

Coenonympha amaryllis amaryllis

Androconia—fig. 13.

Papilio amaryllis Cramer, 1782, 4, p. 210, pl. CCCXCI, figs. a, b.
Papilio amarillis Herbst and Jablonsky, 1783–1804, pl. CLXXXVI, figs. 1, 2.
Coenonympha leandra Hübner, (1823), p. 65.
Coenonympha amaryllis, Herrich-Schaeffer, 1844, 1, p. 86, pl. 41, figs. 188, 189; 1846, pl. 60, figs. 287, 288; Seitz, 1908, 1, p. 146, pl. 48g. (etc.).

Original Description. Plate.

Type-locality. ". . . de la Siberie . . ."

Expanse 28–36 mm. Uniform yellow-ochre above. The number of ocelli that show through from below as black rounds or points varies. There is a dark marginal line contrasting strongly with the light fringes.

Below on the primaries inside the fringes is a dark line within which there is a narrow ashy stripe, then a fine metallic line. The distal area in which lie the varying number of ocelli or points is the color of the upper surface. Within the ocelli there is a narrow irregular pale band backed by a brown line. The inner three-quarters of the wing varies

from light ochre to ashy. On the secondaries, between the metallic line and the six silver-centered and light yellow ringed ocelli, are dark ochre lunules. Within the ocelli is an irregular white band, continuous, broken, or obsolete. The basal half of the wing is ashy.

The sexes are alike.

Coenonympha pavonina (Alpheraky, 1888, p. 66; in Romanoff, 1889, 5, p. 119, pl. V, fig. 8.) described from only one male taken by the Potanine Expedition on the Hei-Ho of Kansu, in which province typical *amaryllis* occur, is in all probability simply an aberrant *amaryllis*, as an examination of the description and plate will show.

Biology. Undescribed.

Range. Easternmost Russia and Asia, generally distributed in a wide band between Lat. 45° and Lat. 60°. The easternmost specimens I have seen are from "the Urals" (BER, STB) Eversmann (1841) reports the insect "circa fluvios Ik et Sacmara provinciae Orenburgensis." Dr. Kusnezov sends the following localities: "Orenburg (Eversmann, Sokolov); Bashkiria (Ménétriès, Staudinger); Spassk (Eversmann); Omsk (Vnukovskij); Tomsk (Meinhardt); Altai (Lederer, Tshugunov, Suvortzev, Meinhardt, Elwes); Barnaul (Meinhardt); Akmolinsk, Atbasar, Kokshetav (Vnukovskij); Semipalatinsk (Suvortzev); Alarsk, Iret River (Kashkarov), Kainsk, Eniseij, Krassnojarsk (Ermolaev); Tshuja Steppe (Emeljanov); Minussinsk (Tshugunov, Kozhantshikov, Ermolaev, Sushkin); Baraba (Tshugunov); Sajan Mts., Urjanchai (Sushkin); Dauria (Bremer, Grum-Grzhimailo); Baikal (Bremer, Vnukovskij); Irkut (Leder, Jurinskij); Transbaikalia (Radde); Kosogol Lake (Grum-Grzhimailo); Bureja Mts. (Radde, Bremer, Korb); Schilka, Zeja (Bremer); Amur (Ménétriès, Bremer, Maack, Hedemann, Korb, Graser); Ussuri (Bremer, Maack, Graser, Kurentzov)."

Semipalatinsk (MCZ), the Tarbagatai (BM), Sandshu Hills of Sinkiang (CAR); Altai, Kara-Ussu (BM); Sajan Mts. (STB, MUN); Troizkossovsk, Borochojewa (MCZ); Tunkinsk (CAR); Irkutsk (BM); Werchne-Uchinsk (WIEN); Changai Mts. (BM, STB); Urga, Schilka River, Chita, Chingan Mts. (STB); Pokrovskaia (transition to *accrescens*—MCZ); Amur region (MUN). A specimen from Jakutsk (BM) shows that the insect may occur considerably to the north of this belt. Generally, east of Long. 110° and south of Lat. 45° occurs *accrescens* of middle and coastal China. To the south and southeast the typical is replaced by *tydeus* and *emmonsi*, although it occurs in the Kuku-nor and Kansu region: Sining (MCZ, STB); Tsinling (MCZ); Nan-Shan Mts. (BER, STB); Richthofen Mts. (STB); Amdo (BM).

Coenonympha amaryllis accrescens

Coenonympha amaryllis accrescens Staudinger-Rebel, 1901, p. 66; Seitz, 1908, 1, p. 146. (etc.).

Original Description. ". . . ocellis majoribus, subt. in facia flava positis; ♂ margine exteriore obscuriore."

Type-locality. "China septentrionalis; Corea."

Expanse 32–40 mm. In this form more dark points or rounds appear on the upper surface than in the typical, and the area between these rounds and the margins is often dusted with dark grey. Below, the appearance is generally ashy, much of the ochre on the secondaries being obscured.

Biology. Undescribed.

Range. Amur region, Corea, costal Manchuria and China at least as far south as Chekiang and reaching its western limit in eastern Szechwan. The boundaries between this subspecies and *amaryllis* are never sharply delineated; typical *amaryllis* seem to occur at random with it at least in the northern and western parts of its range.

Pokrovskaia (MCZ, BM). A series from Mukden (MUN) show "amaryllis", "rinda" and "accrescens" specimens. Kalgan (MUN); Chi-feng-hsien, Tunkia-jingze, Chili Prov. (STB); White-capped Mts., Korea (MCZ); Kikai-nojo, Korea (RO); "Shantung" (MCZ); Peiping (BM, RO); Hay-lung-tau, Wei-hai-wei, Taian (BM); Chefoo (BM, RO); Tsing-tau (RO); Ning-po (MUN); Wenchow, Chekiang Prov. (USNM); Sien, Shensi Prov. (RO); King-yang, Kansu Prov. (USNM).

Type. STB.

Coenonympha amaryllis rinda

Coenonympha rinda Ménétriès, 1859a, pp. 217; 1859b, pp. 42–43.

Coenonympha amaryllis rinda, Staudinger, 1892a, pp. 207–208; Seitz, 1908, 1, p. 146. (etc.).

Original Description. "Alis subdentatis, ochraceis, anticis ocellis tribus paginae inferioris subtransparantibus, posticis immaculatis; subtus pallidioribus, anticis linea interna livida, ocellis tribus albo-pupillatis, posticis fusco-pulveratis, punctis duobus nigris, minutissimis."

Type-locality. ". . . des rives septentrionales de l'Amour."

Size and coloration above as the typical, but with the rounds or points rarely occurring and no dark marginal line or shading. Below the primaries are the same color as above, the apex dusted with light grey. There are one to three much reduced ocelli or points. The

secondaries are uniformly light ashy or brownish grey. If the metallic line is present it is much reduced as are the ochre lunules and ocelli. The angular white mark is also much reduced, and the basal area is dusty blue-grey.

The status of this insect is uncertain. It seems to occur locally in the Amur region. In some places (Mukden—MUN; Chingan Mts.—STB) it flies with the typical, and breeding experiments might very possibly show it to be merely a chance variation of *amaryllis.*

Biology. Undescribed.

Range. "Amur" (BER, MUN); Pompejewka, Chingan Mts. (RO); Blagoveschensk, Raddefskaia (STB); Koslovska (DR).

Amaryllis ordossi (Alpheraky in Romanoff, 1889a, 5, pp. 118–119) described from three males collected by Potanine in Ordos "diffère du type par sa petite taille, ainsi que par sa coloration bien plus pâle."

Amaryllis evanescens (Alpheraky, l.c.) described from four males taken in Amdo "est bien plus remarquable et pourrait facilement, examinée séparément, être prise pour une espèce distincte . . . La teinte des ailes presque comme dans le type de l'*Amaryllis,* les points noirâtres (les rondelles) sur le dessus des premières ailes font défaut. Sur le revers tous les points sont réduits ou disparaissent même complètement, ainsi que le fait la ligne argentée devant le bord extérieur des ailes. Pourtant, chez l'un des individus, dont les rondelles manquent absolument, la ligne argentée est bien nette et lui donne une appearance bien singulière."

I cannot definitely establish the status of these two forms, as I have seen neither the types nor any specimens that agree with the descriptions. In the British Museum are typical *amaryllis* from Amdo (labelled *evanescens*—Elwes ex Grum-Grzhimailo), and specimens from King-Yang, south of Ordos in eastern Kansu (USNM) are *accrescens.* In *tydeus* of Szechwan occurs the same reduction of ocellation described in *evanescens,* yet Alpheraky does not say that *evanescens* is noticeably darker than typical *amaryllis,* which is true of *tydeus.* Possibly, however, more collecting will show the above two forms to be good local subspecies.

Frühstorfer's *tiphon fermana* from Kashgar (1908, p. 2) may be referable to *amaryllis.*

Coenonympha amaryllis tydeus

Androconia—Fig. 14

Coenonympha typhon tydeus Leech, 1892, pp. 96–97, pl. XI, fig. 3.

Coenonympha sinica, Staudinger-Rebel, 1901, p. 67; Seitz, 1908, 1, p. 147; South, 1913, p. 352; Draeseke, 1925, p. 57.

Original Description. "Pale fulvous, usually without markings, but one of the specimens has a small subapical black spot indistinctly ringed with paler; the undersurface is very similar in color and markings to pale forms of the species from the Alps, (*tullia*), but the pale band of secondaries is more broken, and its middle portion represented by a longitudinal bar. The sexes do not differ in color or marking.

Expanse 38-40 mm.

Type-locality. How-kow.

Leech does not mention the traces of the metallic line on the secondaries below backed by brown lunules that marks this, as do the androconia, as a subspecies of *amaryllis*, not *tullia*. He describes it as pale fulvous above; in relation to the other subspecies of *amaryllis* it is dark, being a uniform brown-orange. As he says, the pale band is characteristically reduced to one spot forming a "longitudinal bar." The ocelli are much reduced in size and the secondaries are dusted over with ashy-grey scales. Leech's figure excellently portrays the insect that occurs at middle altitudes from 8000′ to 14,000′. In certain localities at higher altitudes from 14,000′ to 17,000′ occur specimens that may be as small as 30 mm. All markings may have disappeared from the primaries below, and the secondaries may be totally obscured below by ashy blackish scales. The ocelli may be so far reduced as to show nothing more than their metallic centers. The metallic line may also disappear, but the longitudinal white mark generally remains.

When a number of these high-altitude specimens are grouped together they appear to be quite distinct. Inasmuch as I doubt whether they are constant in any locality, I hesitate to separate them. To determine their status we must have more material and notes from regions rarely visited.

Staudinger and Seitz were mistaken in making *tydeus* synonymous with *sinica*, from which it is very distinct, and many collections therefore possess good series of "sinica", which in reality is extremely rare.

Biology. Undescribed.

Range. Szechwan and eastern Thibet.

Samtsa, Chone (CAR); Yu-long-si, Zya-ha Pass, Yin-kuan-tsai-15,000′-17,000′, Sungpan (CAR, USNM); Tatsienlu (OB, BM); Ta-ho (OB); How-kow (BM, RO); Lower Pamei 12,300′ to Tailing 12,600′, Yin-kuan-tsai 12,400′ to Tongolo 12,500′, Chengmengka 12,700′, above Tailing to 14,100′ (Kelley-Roosevelt Exp. '29—RO);

Nagong, Shiuden-Gompa, S. E. Thibet 14,000′ (Kingdon-Ward—BM).

Types. BM.

Coenonympha amaryllis emmonsi subspec. nov.

Average 34 mm. Marked as are high altitude specimens of *tydeus* with reduced or absent ocellation and metallic line and with the same ashy, obscured appearance below. The pale, cuneiform white mark is present, much reduced, or absent. Above, this subspecies is uniformly duller above than *tydeus* with a heavy shading of dusty dark scales. The sexes, as in all forms of *amaryllis*, are alike.

I name this form for a friend and classmate, Arthur B. Emmons, member of the Sikong Expedition to Minya-Gonka in 1932 and of the 1936 Anglo-American Expedition for the ascent of Nanda-Devi.

Range. Lhasa (Walton-Evans—BM); Chaksam, Brahmaputra Valley (Walton—BM); Nang-kar-tse, east of Gyang-tse, S. E. Thibet (Pelle—BM); Samye, Brahmaputra River (Evans—BM).

Types. BM.

Coenonympha sinica

Coenonympha sinica Alpheraky, 1888, p. 66; 1889a, in Romanoff, 5, p. 121, pl. V, fig. 7.

Original Description. "Coen. var. Philoxeno Esp. affinis, differt statura majori (praecipue ♀) strigaque antemarginali alarum omnium subtus argentea. ♂ ♀ 34–41 mm."

Type-locality. "Steppengebiet am Fuss der Nian-Chian-Kette (4. Juni 1886); Stadt Djin-ta-sy (Juli 1886)."

This large insect is dark grey-brown above and below. Alpheraky's figure is excellent as regards both color and markings. I would consider the species closer to *amaryllis* than to any form of *tullia*. *Amaryllis tydeus* from Szetchuan and S. E. Thibet is often confused with it in collections; Seitz' *sinica* is *tydeus*. *Sinica* is probably one of the rarest butterflies in the world; unfortunately I have been unable to examine it for androconia.

Biology. Undescribed.

Range. I have seen only four battered specimens. One is in the collection of Dr. Andr' Avinoff of the Carnegie Museum and is from Sandschu Hills, Sinkiang, (East Turkestan). The other three are in the British Museum—one labelled "Thibet—(Parrish, 1926)", one

"Ladak (Evans)" and one labelled "Sutschou" (in the Richthofen Chain of Kansu?) from the Elwes collection received originally from Grum-Grzhimailo.

Coenonympha symphita symphita

Androconia—fig. 15

Coenonympha symphita Lederer, 1870, p. 44. (♂); Emich, 1872, p. 41. (♀); Romanoff, 1884, 1, p. 65, pl. III, figs. 8, 9; Seitz, 1908, 1, p. 146, pl. 48g; Sheljuzhko, 1929, pp. 351–352. (etc.).

Original Description. "Alis supra ochraceis, puncto anticarum subapicali fusco; subtus anticis ochraceis, ocello ante apicem griseum parvo; posticis virescenti-cinereis, serie ocellorum parvorum sex ante marginem dilutiorum (♂) 30 mm.

Grandeur et coloration de *Davus;* les nervures cependant sans dessin plus foncé et il n'y a qu'une étroite partie du bord mélangée de brun; le dessus ressemble de cette manière à celui d'*Amaryllis;* les franges sont d'un gris-jaune. Dans le sommet de l'aile supérieure un petit ocelle foncé comme chez *Davus;* aux ailes inférieures au devant du bord un ocelle dans chacune des cellules 2 et 3; des ces derniers il manque parfois l'un, parfois l'autre, quelquefois mêmes tous les deux. Le dessous des ailes supérieures est d'un jaune-ocre-brun lavé de gris-verdâtre au sommet; le petit ocelle, à cette place, est entouré de jaune; chez *Davus* on rencontre au devant une bande claire qui manque entièrement ici. Le dessus des ailes inférieures est d'un aspect de feutre gris moisi; au devant du bord, comme chez *Davus*, six points noirs entourés de jaune, depuis la cellule 2 à 7; la bande interrompue pâle, qu'on rencontre chez *Davus*, manque ici." (Lederer).

"Das ♀ dieser hübschen Art ist grösser als das ♂, die Oberseite der Flügel von gleicher ockergelber Färbung wie bei dem ♂, ohne jedoch am Saume dunkler gefarbt zu sein; die Ocellen fehlen auf der Oberseite der Flügel und sind die Franzen länger und grünlich-gelb gefärbt. Die Unterseite der Flügel ist bei dem ♀ die gleiche wie bei dem ♂, jedoch von etwas leichterer Färbung und sind die Ocellen kleiner gekernt. Fl. sp. 32–33 mill." (Emich).

Type-locality. "Dans les montagnes entre Achalziche et la frontière turque."

Biology. Undescribed.

Range. Transcaucasia.

Achalzich (BER), Artwin (STB), Ellensdort (OB). Romanoff (1884) records the insect from Bakouriani, then Sheljuzhko (1929) "Sarjal-Berg, bei Adzhikent", and Korb, (Mitt. Münch. E. G., vol. XI, 1921, p. 7), "im Juli in den sumpfigen Wiesen auf dem Berg Chambobel in 1500 m. Höhe . . ." Herr Sheljuzhko says: "Freilich schalten Heyne . . . und Seitz . . . auch Kaukasus in das Fluggebiet der

Art ein, doch scheinen diese Angaben grundlos zu sein," and in a letter says: "es scheint eine sehr lokale Art zu sein, die bis jetzt nur in weniger Punkten Transkaukasiens gefunden wurde . . ."

Coenonympha symphita karsiana

Coenonympha symphita karsiana Sheljuzhko, 1929, pp. 351–352.

Original Description. ". . . durchschnittlich sind sie etwas grösser und haben grössere und viel mehr konstante Ozellen o- und u-seits.

Vfl'länge der *symphita* ♂♂ 18, 5 mm (nur bei einem ♂ 19, 5 mm), der ♀♀ 18, 5 mm; der *karsiana* ♂♂ 19–20 mm (nur bei einem ♂ 18, 5 mm), des ♀ 20 mm.

Die Subapikalozelle der Vfl. ist bei *symphita* nur useits konstant, oseits scheint sie nur schwach von der Useite durch und verschwindet hier oft völlig. Bei *karsiana* ist diese Ozelle useits bedeutend grösser (besonders auffällig ist die bedeutend breitere schwarze Pupille, die einen grösseren weissen Kern als bei *symphita* trägt) und ist auch oseits stets vorhanden, wobei sie hier nicht nur von der Useite durchscheint, sondern zur Bildung eines rudimentären schwarzen Punktes kommt, was bei *symphita* nur ganz ausnahmsweise vorkommt.

Die Hfl. tragen bei *symphita* oseits keine Ozellen oder Punkte, nur manchmal scheinen die Ozellen der Useite schwach durch. Bei *karsiana* erscheinen hier 2–3 meist recht deutliche schwarze hell umhofte Punkte und scheinen die weiteren Ozellen der Reihe von der Useite durch.

Useits finden wir bei *symphita* eine Reihe von sechs winzigen Ozellen, die aus der schwarzen Pupille und der hellen (gelblich-weissen) Umhofung bestehen, von diesen Ozellen ist die subapikale bedeutend grösser als die übrigen und trägt oft einen weissen Kern. Diese Ozellenreihe hat eine starke Reduktionstendenz, deren verschiedene Stufen mehrfach in meiner Serie vertreten sind. Am häufigsten verschwinden die mittleren 2–3 Ozellen der Reihe in der Weise, dass nur der Subapikalfleck und die 2–3 Flecke vor dem Analwinkel, oder die drei oberen und der letzte (im Analwinkel) erhalten bleiben. In anderen Fällen geht die Reduktion noch weiter, so dass nur die Subapikalozelle und Rudimente von einer der weiteren Ozellen bleiben (bei 2 ♂♂ meiner Serie), endlich können alle Ozellen völlig verschwinden (ein ♂ meiner Serie und ein Uebergangzstück mit einzelnen kaum wahrnehmbaren Ozellenrudimenten). Es möchte wohl zu weit führen, alle diese Formen mit Namen zu belegen, ich glaube nur die extremste Form mit völlig verschwundenen Ozellen der Hfl'-useite als ab. *inocellata* (nov.) bazeichnen zu sollen.

Bei allen mir vorliegenden *karsiana*-Stücken ist die Ozellenreihe vollständig. Die Zahl der Ozellen ist 6–7 (die letzte Ozelle—im Analwinkel—ist manchmal doppelt). Die Ozellen sind bedeutend grösser als bei *symphita* (etwa doppelt so gross oder noch grösser.)

Type-locality. ". . . bei Sarykamish (in der ehemaligen Provinz Kars) . . ."

I have seen no specimens of *symphita* from Kars, but Herr Sheljuzhko's description seems to establish this form as a distinct subspecies.

Biology. Undescribed.

Range. Kars, Transcaucasia. Herr Sheljuzhko says: "Miller (Buller. Soc. Ent. Moscou, vol. II, Nr. 2, 1923, p. 146) gibt an, dass er die Art im Jahre 1911 in der Provinz Kars fand (Schlucht des Tadanka-Flusses, 5000–5500′, 10.-24. VI. und Berg Tshuchur-Tsham, 8500–9000′, 10.-24. VII.). Es wäre wohl anzunehmen, dass diese Stücke mit der hier aufgestellten subsp. *karsiana* übereinstimmen; leider gibt Miller keine Angaben über das Aussehen der Exemplare seiner Ausbeute."

Coenonympha mangeri

Coenonympha mangeri Bang-Haas, 1927, p. 50, pl. 7, figs. 21, 22; Gaede in Seitz, 1930, (Supplement), 1, p. 178, pl. 11g.

Original Description. "Die zu Ehren des Entdeckers neubenannte Art unterscheidet sich oberseits sehr wenig von den hellgelben pamphilus L. Der Apicalpunkt der Vfl ist schwach durchscheinend, die Saumbinde ist schmal. Die Zeichnung der Unterseite der Hfl ist von allen anderen, mir bekannten Coenonympha Arten sehr abweichend. In dem hellbraunen Submarginalfelde befinden sich 5 bis 6 heller umrandete Augenflecke. In dem von der Submarginalbinde bis zur basis gelblich-weiss gefärbten Innenfelde liegen drei tief dunkelbraune Flecken, welche bei einem der ♀♀ bindenartig zusammengeflossen sind. Der erste Fleck liegt oberhalb der Zelle am Aussenrande, der zweite füllt den äusseren Teil der Zelle aus und der dritte unterhalf der Zelle ist dreilappig; Vfl Unterseite ähnelt dem pamphilus Lyllus Esp."

Type-locality. Pagman Mts., Afghanistan.

♂♂ average 27 mm., ♀♀ slightly larger.

This strikingly distinct species, one of the rarest butterflies, is known only from the type series and is probably limited to the mountains of northern Afghanistan. It seems to be related either to the *pamphilus* or *tullia* stocks; the resemblance of its maculation to that of *tullia furcae* from the Grand Canyon of Arizona is striking. Unfortunately I have been unable to examine a male for androconia.

Co-types. STB, RO, MCZ.

Coenonympha hero hero

Papilio hero Linnaeus, 1761, p. 274.

Coenonympha hero, Aurivillius, 1888, p. 35; Petersen, 1924, p. 114; Nördstrom and Wahlgren, 1935, p. 22. (etc.)

Coenonympha hero stolida Schilde, 1885, p. 171; Seitz, 1908, 1, p. 143. (etc.).

Original Description. "Corpus praecedenti paullo majus. Alae primores supra fuscae, versus apicem ocello ferrugineo coeco. Subtus fuscae versus apicem, fasciola albida, margine lutea extra lineam argenteam; ocelli duo inter marginem & fasciolam albidam, quorum exterior iride nigro pupillaque nivea; interior coecus iride lutea punctoque nigro. Posticae supra fuscae, versus postica ocellis sex coecis: iride lutea pupillaque nigra. Subtus fuscae, versus posteriora fascia alba, margine luteo extra lineam argenteam; Ocelli sex inter fasciam albam & marginem: omnes iride lutea, medio atri pupilla nivea. Antennae nigrae annulis albis."

Type-locality. "Habitat in Dalekarlia frequentius . . . Upsaliae rarius."

♂ ♂ average 28 mm., ♀ ♀ slightly larger and lighter, with the ocellation more frequently showing through from below.

The name *hero* should stand for the population of North Europe, where the species is generally smaller than in Central Europe. The undersurface is regularly duller and greyer, and the white band on the underside of the primaries is usually better developed.

Stolida Schilde, from Vestmanland west of Upsala, can hardly be distinct enough from most Scandinavian specimens to be retained; Herr Nordström writes that he considers the name synonymous with *hero.*

Biology. Nordström and Wahlgren, 1935, p. 22.

Range. Southern Norway, Sweden and Finland, the Baltic States and northern Russia, generally between Lat. 55° and Lat. 62°. Danish specimens are transitional to *sabaeus.* Oslo (BM, WIEN); Arvika, "Denmark" Leningrad, Reval, "Livonia" (BM); "Estland" (MUN).

Coenonympha hero sabaeus

Papilio sabaeus Fabricius, 1775, p. 530.

Coenonympha hero, Hübner, (1823), p. 65; Seitz, 1908, 1, p. 143, pl. 48b; Oberthür, 1909, 3, pp. 399–400 (partim). (etc.).

Satyrus hero, Godart, 1823, pp. 544–545.

Maniola hero, Meigen, 1827, pp. 157–158.

Hipparchia hero, Stephens, 1828, pp. 68–69.

Original Description. ". . . . Corpus nigrum. Antennae nigro alboque annulatae. Alae anticae supra fuscae, immaculatae, subtus ocello parvo strigaque postica argentea. Posticae fuscae, ocellis quatuor coecis, intermediis duobus majoribus, subtus basi fuscae, fascia dentata alba, apice fulvae, ocellis sex, pupilla alba strigaque marginali argentea."

Type-locality. "Habitat in Lipsiae nemoribus."

Larger than the preceding and brighter below; the ♂♂ average 30 mm.

This is the familiar insect that has long been known as *hero;* that name is preempted by the Baltic population, and *sabaeus* should stand.

Biology. Goossens, 1884, pl. 5, fig. 41; Hofmann, 1893, p. 23; Gillmer, 1906, pp. 114–115.

Range. Very local—from eastern France through Belgium, Holland, Germany, northern Switzerland and Austria, Czechoslovakia and Poland eastward through Russia ("Urals"—BM ex Grum-Grzhimailo; Sejmonowsk, Central Urals—BER) into Asia, where it meets the eastern subspecies *perseis.* Herr Sheljuzhko writes: ". . . diese Art bei Kijev lokal, aber auf seinen Flugplatzen häufig ist. Sie liegt mir auch aus anderen Punkten des ehemal. Kijev'schen Gouvern. vor, so, aus Umanj und Tljintzy (südlich von Kijev) und aus Korostyshev (westlich von Kijev) vor. Ferner auch aus Volhynien (Zhitamir), von wo sie von Higzopolski . . . als sehr gemein angeführt wird, und aus Podolien (Vinnitza). Auch Podolia und Volhynien wird *hero* in der Litteratur mehrfach erwähnt. . . . Dagegen scheint die Art dem Süden der Ukraine (der jetzigen Odessa-Provinz) zu fehlen.

Ostlich scheint sie eine weite Verbreitung zu haben; es liegen mir Stücke aus diversen Teilen Ost-Russlands vor (Kasanj, Sarapul, Malmysh, Ufa), doch wäre es schwer hier dis genaue Südgrenze ihrer Verbreitung zu fixieren."

Coenonympha hero perseis

Coenonympha hero perseis Lederer, 1853, p. 360; Elwes, 1899, p. 362; Seitz, 1908, 1, p. 143; Oberthür, 1909, 3, pp. 399–400. (etc.).

Coenonympha hero sibirica Fuchs, 1899, p. 126.

Original Description. "Ober- und Unterseite lebhafter, als bei den deutschen Exemplaren;—Vorderrand der Vorderflügel oben oft in beträchtlicher Breite ockergelb, Weiss der Unterseite etwas mehr verbreitet."

Type-locality. ". . . in den Vorbergen des Altai zwischen Ustkamenogorsk und Ustbuchterminsk am Irtisch."

♂ ♂ average 30 mm., females slightly larger. As Lederer says this subspecies is characterized by its lightness and by the wider white bands below. There is more frequent occurrence of ocelli on the upper side than in *sabaeus.*

Sibirica was described from two ♂ ♂ from Krassnoiarsk (Transbaikalia) in the middle of the region where *perseis* occurs commonly. I have not seen the specimens but cannot believe that a series would show it to be distinct enough to retain.

Biology. Undescribed.

Range. Asia from the Urals to the Pacific north of the deserts. Samarkand? (BM); Kentei (STB); Ongodai, Bashkaus, Tchuja Valley, 4000′-5000′ in the Altai (Elwes—BM); Sajan Mts. (BM, STB); Irkutsk, Troizkossovsk (MCZ); Tunkinsk (MCZ, CAR); Apfelbirge, Transbaikalia (RO); Pompejewka, Chingan Mts. (RO); Pokrovka (BM); Raddefskaia (BM, STB); Chabarovka (MUN); "Ussuri" (STB); Ile Askold (OB, STB); Amagin, Tutibe (USNM); Vladivostock (MCZ, RO).

Types. STB.

Coenonympha hero neoperseis

Coenonympha hero perseis, Fixsen in Romanoff, 1887, 3, pp. 313–314; Leech, 1892, 1, p. 95.

Coenonympha hero neoperseis Frühstorfer, 1908, 2, p. 10; Seitz, 1908, 1, p. 143.

?*Coenonympha hero latifasciata* Matsumura, 1925, pp. 94–95; Gaede in Seitz, 1930, (Supplement), 1, p. 175.

?*Coenonympha hero pilwonis* Matsumura, 1925, pp. 94–95; Gaede in Seitz, 1930, (Supplement), 1, p. 175.

?*Coenonympha hero coreana* Matsumura, 1927, p. 164; Gaede in Seitz, 1930, (Supplement), 1, p. 174.

Original Description. "Japanische *hero* sind habituell grösser als sibirische Exemplare, die weisse Binde der Unterseite aller Flügel viel breiter." (Frühstorfer).

Type-locality. "Umgebung von Sapporo."

This subspecies, as Frühstorfer says, is characterized by its size, averaging 34–35 mm.; Corean series show the bands not regularly wider than in *perseis* but nevertheless strongly developed. The ocelli are often so large as to be pressed together at the sides to give a flattened appearance. Some ♂ ♂ have an extremely dark ground color above and below.

Unfortunately I have seen no Japanese specimens; Corean specimens agree with Frühstorfer's diagnosis and on this basis I have considered Japanese and Corean *hero* one variable population.

Matsumura's inadequate descriptions and plates lead me to believe that *coreana, latifasciata* and *pilwonis* are hardly worthy of retention; possibly these had best be identified with *perseis.*

Biology. Undescribed.

Range. Japan and Korea. White-capped Mts. (Suk—MCZ); Ginzanshan, Pungtung (BM); Tokwon, Chikuanshan (MUN).

The Arcania Complex

Every variation between the extremes *insubrica* Frey and *gardetta* de Prunner may be found somewhere within the range of this species, although these variations do not always form a continuous geographic chain. The many hundreds of individuals I was able to examine in European collections showed me this and also that little can be done taxonomically with this morphologically homogeneous complex except on the basis of a long and detailed field study. No such careful study has ever been made comparing the biology or habits of the various forms, and without this any taxonomic arrangement of the group has little true value. No morphological characters are good; it is a great pity that *arcania* should be one of the species without androconia. Taxonomists will criticize me for dropping the names *insubrica* and *epiphilea;* to me these forms seem simply extremes of individual populations.

A great deal of more or less useless information has been published about this complex, and I do not propose to add to it. However, it would seem that the only true geographic populations in the strict sense are what we might call the continental (*arcania*), the Alpine (*gardetta*), the Balkan-alpine (*orientalis*), and possibly the Caucasian (*caucasica*). It is recognized that the problem in this complex depends on the change in altitude and the consequent change in environment; until some more enterprising entomologist has ceased creating names long enough to attack the problem from this angle, we can know nothing.

Plainly, this is an apology for the above treatment of the taxonomy of *arcania*. I can only say that I believe that more study will show that the following do not deserve subspecific status as it is defined in this paper, that the characters on the basis of which they have been separated are not constant. (Those interested should consult Schawerda, 1916 and Verity, 1937).

insubrica Frey
epiphilea Rebel
balestrei Frühstorfer
chrysoaspida Frühstorfer
saleviana Frühstorfer
triumphans Frühstorfer
maesta Verity
opposita Verity
parvinsubrica Verity
tenuilimbo Verity
gracilis Verity
philedarwiniana Verity
tergestina Verity
tyrrhena Stauder
satyrionides Stauder
macromma Turati and Verity
macrophthalmica Galvagni
baltica Goltz

Coenonympha arcania arcania

Papilio arcania Linnaeus, 1761, pp. 273–274.
Papilio amyntas, Scopoli, 1763, pp. 174–175.
Papilio arcanius Linnaeus, 1767, p. 791.
Papilio cephalus Fourcroy, 1785, p. 241.
Coenonympha arcania, Hübner, (1823), p. 65; Seitz, 1908, 1, p. 144, pl. 48d. (etc.).
Satyrus arcania, Godart, 1823, pp. 546–547.
Maniola arcania, Meigen, 1827, pp. 156–157.
Hipparchia arcanius, Stephens, 1828, p. 69.
Coenonympha arcanius, Oberthür, 1910, 4, pp. 23–27. (etc.).

Original Description. "Parvus. Alae Primores supra antice ferrugineae, postice nigricantes margine albido; Subtus ferrugineae, versus apicem ocello minutissimo. Posticae supra fuscae margine albido; subtus griseae: postice linea argentea; medio fascio lata alba; ocellus ante fasciam, ad marginem exteriorem, niger; ocelli quattuor ad postica fasciae albae, pupilla argentea: horum ocelli duo ano propiores majores. Praecedenti facie accedit."

Type-locality. (Sweden?).

Further description of this well-known insect is not necessary. The females are very slightly larger and lighter than the males, which average 34–35 mm.

The spelling *arcania* was used first by Linnaeus and should stand.

Butler (1868, p. 42) described *C. marginalis* from a single specimen wrongly labelled "Algeria." No *arcania*-form occurs in Africa; the specimen obviously is from some indeterminable *arcania*-population of Europe and as a type is invalid.

Biology. Hübner, (1796)-(1841) Papiliones, I. Nymphales, F.c. fig. 1a; Ochsenheimer, 1807, 1, p. 319; Godart, 1821, Diurnes, I, p. 175; Boisduval, Rambur and Graslin, 1823, pp. 3–4, pl. 3, figs. 7, 8, pl. 4, figs. 4–7; Duponchel, 1849, 1, pp. 206–207, Pl. XXX, fig. 87; Wilde, 1861, p. 38; Hofmann, 1893, pp. 23–24, pl. 5, fig. 16.

Range. Continental Europe, from Spain to the Urals. Aurivillius (1888) says that in Scandinavia it extends only as far north as Lat. 60°, and Dr. Kusnezov sends me as its northernmost Russian localities: "Vjatka (Krulikovskij); Perm (Holtzermann); Jarroslavl (Krulikovskij); Pskov (Kusnezov)." It apparently reaches its southern limits in Turkey (Tokat—OB, Zebil-Taurus—BM) and Transcaucasia (Achalzich—STB).

Concerning the species in the Caucasus and Transcaucasia Herr Sheljuzhko writes: "Ich möchte . . . erwähnen, das . . . *caucasica* (Jachnontov, 1914) eine ausgesprochene *arcania*-Rasse ist und in

nächsten Verbindung mit *insubrica* steht, nicht aber mit *darwiniana* . . . Ob in der Tat irgendeine *satyrion*-Rasse (=*gardetta*) im Kaukasus fliegt bleibt recht fraglich . . ." He records the following localities for *caucasica:*

"Nord-Kaukasus: Koslovodsk, Zheleznovodsk, Vladikarkoz.

Transkaukasien: Borzham, Bakuriani (bei Borzham), Mitarba (bei Bakuriani), Aba-tuman, Betaria (bei Tiflis), Mzchet, Tzarkoje Kolodtzy, Jelisavetpol, Berg Kozluch (bei Jelisavetpol), Adzhi-kent."

Unfortunately I have seen no *caucasica* and cannot satisfy myself as to their status; they evidently stand near the large bright *arcania* from certain Alpine localities that has been named *insubrica.*

Arcania probably does not occur in Asia. Dr. Kusnezov says that Erschov's Omsk record is extremely doubtful; Uchida (1931) actually records the insect from Japan!

Types. LS (?). Concerning the specimens in the Linnean Society in London which I was able to see in the summer of 1936 Dr. Verity (1913) says: "Though not marked as possessed by Linnaeus, there are two specimens which unmistakably come from his collection, and one bears a label of his. They belong to a very small northern race and are presumably Scandinavian. The marginal black bands of wings are very wide; on the under side the white band of hind wings is narrow and the ocelli small." We have seen that Dr. Verity's race-concept differs from that of most entomologists. Whether these specimens are or are not the valid types, Scandinavian *arcania* ("Sweden" —Lampa, BM; Aurivillius, Nordström and Wahlgren etc.) are not distinct enough from those of central Europe to warrant the use of a later name for specimens from the latter region.

Coenonympha arcania clorinda

Coenonympha arcania clorinda de Sagarra, 1924, p. 199; Gaede in Seitz, 1930, (Supplement), 1, p. 176.

Original Description. "Difereix de *C. arcania hübneri*, Obth., pel espais de color lleoni molt mes extesos en les ales posteriors, omplenant el lobul anal."

Type-locality. Orihuela del Tremedal.

The large ochre patch on the upper surface of the secondaries is characteristic, and the whole under side is paler than that of the typical. Size as the typical.

Biology. Undescribed.

Range. Central Spain. Orihuela del Tremedal (BM, PANS); Cuenca (RO, USNM); San Ildefonso (RO); Albarracin (WIEN).

Coenonympha arcania darwiniana

Coenonympha arcanius var., Herrich-Schaeffer, 1844, I, pl. 41, figs. 186–187.
Coenonympha arcania darwiniana Staudinger, 1871, p. 32; Seitz, 1908, 1, p. 146. (etc.).
Coenonympha darwiniana, Oberthür, 1910, 4, p. 28. (etc.).

Original Description. ". . . . v. subalpina, minor, al. post. subt. fascia tenui alba, transitus ad sequ. form. (*satyrion*)."

Type-locality. "Alpes, Helvetia meridionalis, Pedemontium, Gallia, (et? Germania meridionalis)."

♂ ♂ av. 31–32 mm., marked as *arcania* with a slightly wider dark margin on the primaries above. The white band on the secondaries is reduced and the ocelli, more of a size, lie on its outer margin. They are small, eyed with white and edged by a narrower paler ring than that in *arcania.* The females are slightly larger and the ochre is paler.

Biology. Undescribed.

Range. Middle altitudes in the Basses Alpes, southern Switzerland and the south Tyrol.

Basses-Alpes (OB); Wallis, Tessin (BM); Fusio (OB, RO); Bosco, Locarno (RO); Laquintal, Adamello (WIEN).

Types. STB.

Coenonympha arcania gardetta

Genitalia—fig. 29.

Papilio gardetta de Prunner, 1798, p. 74; De Loche, 1801, p. 146, pl. 8, figs. 7, 7a.
Papilio philea Hübner, (1799), pl. 53, figs. 254–255.
Papilio neoclides Hübner, (1805), Text, p. 41.
Papilio satyrion Esper, 1806, I, (Supplement), pp. 24–25, pl. XXII, fig. 2.
Coenonympha neoclidis Hübner, (1823), p. 65.
Satyrus phileus Godart, 1823, p. 457.
Maniola philea, Meigen, 1827, p. 158.
Hipparchia satyrion, Freyer, 1842, 4, p. 137, pl. 367, figs. 1, 2.
Coenonympha satyrion, Herrich-Schaeffer, 1844, 1, p. 86; Heyne in Rühl, 1895, p. 614; Tutt, 1896a, pp. xlii–xlvii; 1896b, pp. 256–258. (etc.).
Coenonympha philea, Kirby, 1871, p. 98. (etc.).
Coenonympha arcania satyrion, Staudinger-Rebel, 1901, p. 65; Seitz, 1908, 1, p. 144, pl. 48d. (etc.).
Coenonympha gardetta, Verity, 1927, pp. 37–40, 70–74.

Original Description. "Alis extus terreo-flavis; intus primoribus duabus fasciis transversis, una marginale flava, altera alba, ocellis quattuor nigris albe punctatis."

Type-locality. ". . . valle Varaitana . . ."

Average 29–30 mm. There is much variation in the amount of ochre appearing on the upper surface of the primaries from specimens with it so completely obscured as to produce a slaty appearance to ones approaching the coloration of *darwiniana.* The ochre on the secondaries, limited in *arcania* to a narrow short patch at the anal angle, may be extended forward to give a narrow marginal band; in some specimens this may be present on both primaries and secondaries. The ochre on the under side of the primaries is generally unobscured and the apical point often lost. The white band on the secondaries is narrow while the ocelli are reduced in size and along the outer margin of the band. The costal ocellus is often at the outer edge of the band or just within it—not at the inner edge as in *arcania* and *darwiniana,* although this is not regular. The basal area of the secondaries is often densely slaty hairy. The females show the same amount of variation in darkening above, but the ochre is lighter and may therefore give very much the same appearance as females of *amyntas.*

Concerning the precedence of the name *gardetta* I quote Dr. Verity (1927): ". . . De Prunner in his *Lepidoptera Pedemontana,* p. 74, has, in 1798, named *gardetta* an insect which Chiliani seems unquestionably right in referring to *philea* Hb. De Prunner says it is not rare in the Varaita Valley in June and from his description it is quite recognizable. The date of issue of Hübner's figure is not certain, but even were it 1798, a description has, *ceteris paribus,* precedence over a figure according to the accepted Rules of Nomenclature, and *gardetta* should stand instead of *philea* and *satyrion.*" Furthermore, the Comte De Loche, writing on the butterflies of Piedmont (1801), unmistakably figures *gardetta* and quotes De Prunner's description.

Biology. Undescribed.

Range. The higher alpine valleys of eastern France, Switzerland, northernmost Italy, Bavaria and the Austrian Tyrol.

[Coenonympha khinganensis]

Coenonympha khinganensis Mori and Cho, 1938, p. 7.

I have seen no specimens of this insect which Mori and Cho describe as being close to *arcania satyrion.* Inasmuch as no members of the *arcania* complex have been discovered in Asia, I would be inclined to believe that this form is related to *amyntas* and possibly identifiable as *amyntas iphicles.* It is described from Khing-an in Manchuria.

Coenonympha arcania orientalis

Coenonympha arcania philea, Rebel, 1904, pp. 174–175, pl. V, fig. 9.
Coenonympha arcania orientalis Rebel, 1910, p. 65; Gaede in Seitz, 1930 (Supplement), 1, p. 176.

Original Description. ". . . . . ist ein der epiphilea seht nahestehende Form mit Ockerbraunen Vfl des ♂, die Useite der Vfl mit stets doppeltem Apikalauge und deutlicher breiter Bleilinie vor dem Saum. Die Hfl mit breiterer weisser Binde als bei epiphilea." (1910).

Type-locality. "aus Ostbosnien . . ."

♂ ♂ average 31 mm., ♀ ♀ slightly larger and lighter. There is a well-developed ochre anal patch on the upper side of the secondaries.

As Dr. Rebel says the closest relative of this subspecies seems to be the form of *gardetta* with the reddish flush on the primaries (*epiphilea* Rebel), which I have not found to be regular in any region. The double apical ocellus, the heavy black ocelli on the secondaries with only the narrowest ring, and the very wide white band will serve to distinguish this insect from the Alpine subspecies.

Biology. Undescribed.

Range. Higher altitudes in Bosnia and Herzegovina. Vucijabara (BER, RO, WIEN); Ljuburica, Stolac (WIEN).

Types. WIEN.

Coenonympha arcanioides

Satyrus arcanioides Pierret, 1837, pp. 306–307, pl. 12, fig. 5.
Hipparchia arcanioides, Freyer, 1845, 5, p. 125, pl. 457, fig. 1.
Coenonympha arcanioides, Herrich-Schaeffer, 1851, pp. 18–19; 1854, 1, pl. 121, figs. 580–581; Oberthür, 1910, 4, pp. 19–23; 1915, 10, pp. 360–361; Rothschild, 1917, p. 117; 1925, p. 207.
Coenonympha arcanoides, Oberthür, 1876, 1, p. 28.
Coenonympha arcanioides major Seitz, 1908, 1, p. 144, pl. 48e.
Coenonympha arcanioides holli Oberthür, 1910, 4, p. 20.

Original Description. "Ce Satyre, qui doit se placer auprès de l'Arcanius, a le dessus des ailes d'un brun cendré, avec une large tache fauve aux supérieures, tache qui occupe les deux tiers de l'aile. Les inférieures offrent à l'angle anal une liseré fauve qui s'avance en s'amincissant jusque vers le milieu du bord postérieur, et un peu moins ver le bord antérieur. On distingue en outre un petit oeil noirâtre cerné de fauve, situé au-dessus de l'angle anal, à quelque distance au liseré dont nous venons de parler. La frange est cendrée, un peu fauve vers l'angle postérieur des premières ailes.

En dessous, les ailes supérieures sont fauves, brunâtres vers les bords antérieurs et postérieurs. On y voit un liseré argenté qui longe le bord externe, et vers le sommet un oeil noir pupillé de blanc et cerné de fauve. Entre l'oeil et le sommet on remarque une légère nuance d'un jaune roussâtre, et sur le côté interne de l'oeil, une ligne jaunâtre, sinuée, qui s'affaiblit en descendant vers l'angle postérieur. Les ailes inférieures sont d'un brun-tanné-verdâtre; elles sont traversées, un peu au delà de leur milieu, par une bande blanche un peu courbé, avec les bords sinués. Cette bande, qui s'atténue vers l'angle anal, est longée à son bord interne d'une série de cinq yeux noirs pupillés de blanc et cernés de fauve. L'espace entre les yeux et le bord externe est un peu nuancé de jaune roussâtre, et près de ce bord on voit un liseré argenté comme dans les ailes supérieures.

La tête, le corps et les pattes sont bruns. Les antennes sont blanches et réticulées de noir, avec la massue de cette dernière couleur."

Type-locality. ". . . Oran, dans le Barbarie."

The early generation averages 29–30 mm. The ochre of the females is very slightly lighter than that of the males. Oberthür says of the late generation: "Les papillons sont plus petits et plus obscurs en septembre qu'au printemps; sur les ailes supérieures en dessus, l'espace fauve se trouve tres réduit et le dessous des ailes est plus foncé."

Seitz (1908) says: "The two broods overlap, and in the first days of June I often caught fresh specimens of the second brood together with worn ones of the first. The butterflies are beaten out of the bushes overhanging the roads; they have a special preference for blackberry bushes. They have exactly the same habits as the small *Epin. ida* ♂♂ occurring in such places in Algeria and can hardly be distinguished from these when on the wing. During the hottest part of the day they hide in dried-up beds of streams and in ditches. They always fly close to the ground and so often among thorny bushes that they are difficult to get at."

Butler's (1868) *marginalis*, supposedly from Algeria, is an *arcania.*

Biology. Undescribed.

Range. The northwestern coast of Africa from northern Morocco to Tunis.

Sebdou, Bône, Djudjura, Cap Aokas (OB); Gibraltar, Tangier, Phillipeville, Constantine, Benzus Bay, Klasta, Hawara (BM); Algiers (BM, RO); Hammam R'ihra, Rovigo (OB, RO); Lella Kredidja, Aïn Draham, Hussein Dey, Maison Carrée, L'Arba, Dellys, Gué, Col de Chênes, Col de Chréa, Masser Mines, Oran, Blida-les-Glacières, Bou Saada (RO).

Coenonympha leander

Papilio leander Esper, 1784, I, 2, p. 176, pl. LXXXIX, fig. 5.
Papilio philaidilis Borkhausen, 1788, p. 93.
Papilio clite Hübner, (1803)–(1804), pl. 103, figs. 526–527; (1805), Text, p. 41.
Coenonympha leandra Hübner, (1823), p. 65.
Satyrus leander, Godart, 1823, p. 548.
Maniola leander, Meigen, 1827, pp. 155–156.
Coenonympha leander, Herrich-Schaeffer, 1844, 1, p. 86, figs. 184–185; Seitz, 1908, 1, p. 144, pl. 48c. (etc.).
Coenonympha leander obscura Heyne in Ruhl, 1894, p. 640.

Original Description. "Es hat dieser Falter die nächste Aehnlichkeit mit dem Papilio *Arcanius.* Von dem Hero ist der Abstend schon weit mehr beträchtlich, als dass ich nöthig hatte, ihn anzuzeigen. Die Grundfarbe ist ockergelb, und an den ausern Rand in beträchtlicher Breite mit schwärzlichen Atomen bestreut. Gegen die Spitze stehet ein blindes Aug, das auf der Unterseite deutlicher und mit einer weissen Pupille verschönert sich zeigt. Die Ausenseite der Hinterflügel ist von einfärbigen Braun mit einem rostfärbigen Saum gerandet. In diesem stehen schwarze gerundete Flecken. Schon dadurch ist dieser Falter von dem P. Arcanius genugsam verschieden. Die Unterseite aber giebt noch grösere Abweichungen an. Es ist die Grundfarbe ein helles Aschgrau mit dem die Fläche bis auf dem rothgelben Saum ganz einfarbig bemahlt erscheint. In parallelen Abstand vom Rand nimmt sich hier eine Reihe von sieben Augen ganz vorzüglich aus. Sie stehen in bogenförmiger Reihe in gleicher Entfernung, und es ist hier nicht das letzte gegen die Grundfläche, wie an erst erwähnten Falter durch einen Zwischenraum gesondert. Das übrige wird die eigene Vergleichung genugsam ergeben . . . . "

Type-locality. ". . . an der Wolga. . ."

Males average 32 mm., females generally slightly larger. Upper side of the primaries in the males ochre, more or less obscured toward the edges with dark grey; in some specimens the grey covers the entire wing. The secondaries are dark grey with an anal patch of ochre that at times extends forward to form a marginal band. The ocellation shows through from below. Below, the primaries are a uniform orange-ochre with no obfuscation at the apex and with apical ocelli. The ground color of the secondaries below is also orange-ochre, only the outer third with the ocelli being unobscured, the inner two-thirds dusted over with ashy scales becoming more concentrated towards the base which is slaty-hairy. There is a well developed metallic line edging the wing.

Females are marked as the males, the ochre lighter, with less tendency towards shading of the primaries.

The males of this species somewhat resemble the males of *amyntas iphioides* above, but *leander* is not closely related to it. The marking below is distinct; *leander* has no androconia.

Obscura is the dark extreme apparently occurring everywhere.

Biology. Undescribed.

Range. Locally, from Rumania eastward across southernmost Russia to the Urals (Orenburg) and southeastward through Bulgaria, Turkey and Armenia into Persia.

"Hungary" (BM, MCZ); Mehadia (STB); Kisilskaia, Urals (BER, DR); Güberlinsk, Urals (STB); Rilo Dagh, Bulgaria (Elwes—BM); Slivno, Rumelia (BM, WIEN); Schipka, Rumelia (WIEN); Amasia (BM, STB); Ak-Chehir, Anatolia (MUN); Van, Armenia (BM); Kasikoparan, Transcaucasia (BM); Hadschyabad, Persia (BM).

Coenonympha nolckeni

Coenonympha nolckeni Erschoff in Fedtschenko, 1874, II, p. 23, pl. II, fig. 17; Grum-Grzhimailo in Romanoff, 1890, 4, p. 497; Seitz, 1908, 1, p. 143, pl. 48b. (etc.).

Original Description. "Alis supra rubigineo-fuscescentibus, obscurius marginatis; subtus anterioribus laetius rubescentibus bi-vel tri-ocellatis, posterioribus griseofuscescentibus, ocellis sex ante marginem rufescentem.

Exp. al. ant. ♂ 36–37, ♀ 39 mm."

Type-locality. ". . . in monte Naubid in Turkestano Rossico, . . ."

The secondaries of the male are dark brown above with a short, brown-ochre anal patch; those of the female are flushed with red-brown, and the anal patch is extended as a marginal row of ochre lunules, appearing also on the primaries. There is no metallic line below.

Biology. Undescribed.

Range. From the Altai Range southwestward through Russian Turkestan to eastern Transcaspia.

Altai Mts., Kuldja Dist. (BM); Kappak, Alexander Mts. (RO); Tian-Shan Range (MUN); Karagaitan, southern Narynsk (STB); Tashkent (MCZ); Margalen, Namangen (BM, STB); Samarkand, Schachrimorkan (BM); Usgen, Osch, Bokhara (STB); Gharm, Hissar Mts. (STB); Serafschan Range (BM, BER); Merw, Transcaspia (STB).

Coenonympha dorus dorus

Androconia—fig. 19

Papilio dorus Esper, 1782, I, 2, pp. 130–131, pl. LXXVIII, fig. 1.
Papilio lizetta Cramer, 1782, 4, p. 166, pl. CCCCLXXIII, figs. F, G.
Papilio dorilis Borkhausen, 1788, p. 93.
Papilio dorion Hübner, (1799), pl. 52, figs. 247–248.
Coenonympha dorilis, Hübner, (1823), p. 65.
Satyrus dorus, Godart, 1823, pp. 547–548.
Maniola dorus, Meigen, 1827, pp. 158–159.
Coenonympha dorus, Herrich-Schaeffer, 1844, 1, p. 85; Seitz, 1908, 1, p. 145, pl. 48f; Oberthür, 1910, 4, pp. 31–38, pl. XLVIII, fig. 389; 1925, 22, pt. II, p. 12.
Coenonympha dorus fonti de Sagarra, 1924, II, 4, p. 199.

Original Description. " . . . . Er ist etwas kleiner, und in dem Umriss der Flügel um vieles geschmeidiger gebildet, als der P. hero. Die Grundfarbe der Aussenseite der Vorderflügel ist nur wenig mit Braunen angeflogen, sie ist mehr mit Ockergelb gemischt. An jenem Falter hingegen ist sie ganz schwärzlich braun. An der Flügelspitze stehet ein Aug, und daneben zwei kleinere. Letztere sind nicht bestandig vorhanden. Auf der Unterseite ist nur ein einzelnes da, und dieses führt eine weisse Pupille. Hier ist die Grundfarbe von hellem Gelb, auf welcher eine blasse Binde, mit silberglanzenden Saum, wie an jener Art zu stehen. Die Oberseite der Hinterflügel ist nach dem Rand mit einer schwarzen Einfassung, welche spitzwinklichte Ecken bildet, umzogen. Die mittlere Flache aber ist ganz hellgelb gelassen. Die vier Augen, denen auch hier die Pupillen mangeln, sind kleiner, und stehen in einer mehr einwarts gebogenen Krümmung. Aug der gleichfarbigen Unterseite hält die weisse Binde eine gerade Richtung, schrege durch den Flügel. In gleicher Breite stehen unter derselben fünf kleinere Augen, mit weissen Sehstrahlen versehen. Das sechste zur Seite der Oberflugel ist durch die weisse Binde von den ubrigen abgefondert. Dies wird man an dem gemeinen P. Hero nicht gewahr. Auch die Linie von bleifärbigen Glanz ist hier nicht, wie bei jenem, mit dem Rand gleichlauffend, sondern mehr kappenformig gezogen. Der Hinterleib ist nach der Farbe gleichfalls verschieden, er ist nicht schwarz, sondern mit Gelbem bemahlt . . . . "

Type-locality. ". . . auf dem Gebirgen von Languedoc . . ."

Average 30–31 mm. Oberthür says: "La ♀ diffère du ♂ en ce qu'elle est entièrement d'un fauve orangé, en dessus, plus ou moins clair ou foncé, avec la bordure des ailes d'un brun noirâtre, traversée parallèlement au bord marginal par un liséré fauve."

Cotypes of *fonti* (MCZ) cannot be distinguished from the typical from southern France; the name is, therefore, an absolute synonym.

Biology. Undescribed.

Range. Southern France, not occurring north of Lat. 45°, westward and southward to southern Spain, where it imperceptibly merges with *andalusica.*

Gironde (MCZ); Hautes-Alpes (OB); Basses-Alpes, Alpes Maritimes, Vernet, Briançon (BM); Marseilles (RO); Toria, Ainsa (WIEN); Barcelona (MUN); Tarasa (RO); Albarracin (MCZ, RO, WIEN); Cuenca (MCZ, RO); Orihuela del Tremedal (RO, PANS).

Coenonympha dorus microphthalma

Coenonympha dorus microphthalma Oberthür, 1910, 4, p. 33, pl. XLVIII, fig. 388; Gaede in Seitz, 1930, (Supplement), I, p. 177.

Original Description. "La couleur jaune du dessous des ailes est assez variable; elle tend à être plus uniformément jaune foncé chez les *Dorus* de la Lozère et de l'Aveyron, ... De plus, les *Dorus* de la Lozère et de l'Aveyron ont l'ocellation bien plus petite et moins accentuée que dans les départements plus meridionaux."

Type-locality. La Lozère, l'Aveyron.

In the males the primaries are less obscured above with dark scales than in the typical; the rounds appearing on the upper side of the secondaries are reduced and the dark border is reduced or absent toward the anal angle. Below, the primaries and secondaries are a uniform buff orange. The pale bands are only vaguely distinguishable from the rest of the wing.

In the females above the dark scaling is reduced to a very narrow band on the primaries and is all but absent on the secondaries.

Biology. Undescribed.

Range. Good series in the Oberthür collection show this to be regularly distinct from the typical in the Depts. La Lozère and l'Aveyron in south France.

Types. OB.

Coenonympha dorus mathewi

Coenonympha mathewi Tutt, 1904, pp. 308–309.

Coenonympha dorus mathewi, Chapman and Champion, 1907, pp. 152–155, pl. V, figs. 1–12; Oberthür, 1910, 4, pp. 35–36.

Original Description. "♂ Anterior wings fuscous, sprinkled with glossy, golden-brown scales, a faint apical, ocellated spot. Posterior wings same color as forewings; a pale, orange-brown patch from anal angle to middle of wing; 2 (or 3) faint ocellated spots from anal angle just outside orange patch; fringes white. Underside of forewings bright orange-brown, a distinct, black, small, white-pupilled, ocellated, apical spot, with dark marginal shade, including

narrow, faint, metallic line parallel to outer margin; of hindwings golden-brown, a narrow, white, median, transverse band inside row of tiny ocellated spots, of which 1 and 5 (counting from anal angle) are nearly obsolete; outside area same color as base (sometimes with faint metallic line parallel to outer margin). ♀ Forewings rather square at apex; orange-brown, with broad, fuscous, outer marginal band and ocellated spot. Hindwings with rather more orange than the male in center of wing, 3 clear orange-ringed ocellated spots, and orange marginal line; fringes rather darker grey; underside as in ♂."

Type-locality. ". . . about three miles to the south of Vigo."

Chapman and Champion (1907) give a complete discussion and plates showing the variation in this subspecies; however, examination of Staudinger's types of *bieli* shows that *mathewi* is distinct from it, a fact concerning which the two authors are doubtful. By the rich orange-brown tinge of the color appearing above and of the whole lower surface, which Tutt stresses, one can easily distinguish this subspecies from *bieli*.

Biology. Chapman and Champion, 1907, pp. 154–155.

Range. Northwestern Spain. Casayo, Branuelas, Pontevedra, Vigo (BM).

Coenonympha dorus bieli

Coenonympha dorus bieli Staudinger-Rebel, 1901, p. 65; Seitz, 1908, 1, p. 145; Oberthür, 1910, 4, p. 35.

Coenonympha dorus semibieli Verity, 1929, pp. 185–186; Gaede in Seitz, 1930, (Supplement), I, p. 177.

Original Description. " . . . al. post. supra in ♂ et ♀ fere totis obscuris, subt. ocellis minoribus, linea argentea obsoleta vel subnulla."

Type-locality. Oporto, Villa Real (Portugal).

Males average 30 mm., females 31 mm. Upper surface of the primaries in the males totally obscured, with the apical ocelli vaguely showing through from below; of secondaries, obscured, some specimens with an orange patch. Females with a large orange patch on the upper surface of the primaries, sometimes dusted over with dark scales. Most females possess an orange patch on the upper side of the secondaries, but in a few this is totally obscured.

On the under side the males are marked as in typical *dorus*, the primaries being clear orange-ochre, not brown-ochre as in *mathewi*. The ocellation and metallic line are reduced; the whole surface has a greenish-buff tinge in contrast to the clear buff of *andalusica* or the brown of *mathewi*. The females are marked as the males below.

It must be admitted that Staudinger's description is inadequate, but

comparison of Serra d'Estrella specimens with the types of *bieli* would have shown Verity that they are identical. There is therefore no reason to retain the name *semibieli.*

Biology. Undescribed.

Range. Northern Portugal. Serra d'Estrella (MCZ, PANS, USNM); Oporto, Villa Real (STB).

Types. STB.

Coenonympha dorus andalusica

Coenonympha dorus andalusica Ribbe, 1906, p. 243, pl. VIII, fig. 17; Seitz, 1908, 1, p. 145; Oberthür, 1910, 4, p. 34, pl. XLVIII, figs. 390, 391, 392.

Original Description. " . . . Schon die Form der Flügel weicht von der echten dorus etwas ab. Die Vdflgl. sind bei beiden Geschlechtern gedrungener, die Htflgl. mehr rundlich. Der Saum der Htflgl. ist scharf wellenförmig ausgebogt, sodass die dem Aussenrande parallel laufenden dunklen Linien scharf gezackt sind.

♂ Die Oberseite der Vdflgl. ist durchgängig dunkler, das Flügelspitzenauge tritt nur wenig hervor, oft gar nicht, selten als zwei kleine gelb geringelte unter einanderstehende Flecken.

Nicht zu haufig stehen unter dem ebenerwähnten Auge zwischen den Rippen gelbe Wischer, die sehr selten so stark auftreten, dass der ganze Vdflgl. dadurch ein helleres Aussehen erhält.

Die Htflg.-Oberseite zeigt die Augenreihe nur verloschen, oft gar nicht. Die Unterseite ist heller, stumpfer, die Augenflecken besonders auf den Htflgl. sind klein, die Metallinien nur schmal.

♀ Die Oberseite verdunkelt, es kommen Stücke vor, die zur var. *bieli* neigen, d.h. sehr verdunkelte Htflgl. haben. Unterseite wie bei dem ♂ sehr hell . . . . "

Type-locality. ". . . bei Granada, in der Sierra de Alfacar und Nevada . . ."

Some specimens from the Sierra de Alfacar (BM, OB) and the Sierra de la Luna (MCZ) have on the secondaries very reduced ocellation and a vague pale band and make a transition to *fettigii* through *picholasi.* Furthermore some males of this subspecies show the beginnings of the ochre chevron below the ocellus on the upper side of the primaries that is characteristic of both *nicholasi* and *fettigii.*

Biology. Undescribed.

Range. Southern Spain. "Andalusia" (MCZ); Gibralter (BM); Sierra Nevada (BM, RO, STB, MCZ, USNM, PANS); Sierra de Alfacar (RO, STB); Algarve de la Lluvia (DR, WIEN).

Types. STB.

Coenonympha dorus inframaculata

Coenonympha fettigii, Blachier, 1908, p. 216.
Coenonympha fettigii inframaculata Oberthür, 1922, 19, p. 87; Gaede in Seitz, 1930, (Supplement), 1, p. 177; Rothschild, 1933, p. 321.

Original Description. "Ch. Blachier (*Ann. Soc. Ent. France*, 1908, p. 216) a bien raison de faire remarquer que le *Coen. Fettigi*, du Maroc, diffère de la race algérienne de la même Espèce, par la grandeur de la tache claire du dessous des ailes inférieures. Blachier ajoute que cette tache, qui s'appuie sur la ligne transversale, s'étend parfois jusqu'à la ligne argentée subterminale." (Oberthür, 1922).

Type-locality. ". . . au fort de Toumliline . . ."

Lord Rothschild (1933) adds: "Above they vary much in the ♂ ♂, some having the fore-wing uniform fuscous, thence running through all stages to a broad rufous postmedian band."

Biology. Undescribed.

Range. French and Spanish Morocco, Taghzeft (Powell—OB); Amez Miz, Atlas (MCZ); Imentalla, Atlas (Meade-Waldo—BM); Ketama, Cuernos de Xauen (Romei—RO); Xauen a' Faska (WIEN).

Types. OB.

Coenonympha dorus fettigii

Coenonympha fettigii Oberthür, 1874, p. 412; 1876, 1, pl. I, figs. 4a, 4b; 1910, 4, pp. 38–43, pl. XLVIII, figs. 398–399; 1925, 22, II, p. 62, Pl. DXCIII, figs. 5021–5023; Seitz, 1908, 1, p. 145, pl. 48f; Rothschild, 1917, p. 118.

Original Description. "En dessus, le *C. Fettigii* diffère du *Dorus*, parce que l'aile supérieure, au lieu d'être uniformément grise, est traversée verticalement par une large bande fauve, dont le sommet entoure le petit point noir ocellé du dessous qui reparaît en dessus par transparence. Les ailes inférieures sont comme celles de *Dorus*, mais plus vivement colorées et plus envahies par le couleur fauve.

En dessous, le sommet de l'aile du *C. Fettigii* est d'un gris verdâtre qui entoure la petite tache noire ocellée placée comme dans *Dorus* et cerclée aussi d'un liséré fauve. Cette teinte grise descend jusqu'au milieu de l'aile, près du bord extérieur, dont elle se rapproche en s'amincissant.

L'aile inférieure est en entier d'un gris verdâtre uniforme, traversé par une petite éclaircie linéaire qui coupe l'aile par le milieu. On voit seulement deux très petits points ocellés: l'un près de l'angle anal, l'autre en haut de l'aile. Un filet d'argent très-brillant et très-mince longe en dessous le bord extérieur des deux ailes, comme cela a lieu dans d'autres espèces de *Coenonympha* . . . . ."

Type-locality. Telaghre (Algeria).

The males average 30 mm.; females larger, some as large as 35 mm. The ochre of the primaries of the females covers most of the wing instead of being a chevron-like mark as in the males. The rounds on the upper surface of the secondaries are almost always absent and some specimens are totally unocellated below.

Biology. Oberthür, 1915, 10, pp. 445–446, pl. CCCVII, figs. 4559–4568.

Range. Coastal region of western Algeria. Telaghre (Oberthür, 1874); Sebdou (BM, RO); El Mirzab, Sidi-bel-Abbes, Masser Mines, Les Pins (RO).

Types. OB.

Coenonympha dorus nicholasi

Androconia—fig. 20

Coenonympha fettigii holli Oberthür, 1910, 4, p. 42, pl. XLVIII, figs. 396–397; Rothschild, 1917, p. 118; Gaede in Seitz, 1930, (Supplement), 1, p. 177.

Coenonympha fettigii nicholasi nom. nov., Rothschild, 1925, p. 208.

Original Description. ". . . de plus petite taille que *Fettigii* de Sebdou, d'une teinte fauve moins vive et dont le dessous des ailes inférieures est d'un gris plus jaunâtre, avec l'éclaircie plus étendue et les petits ocelles noirs, cerclés de fauve et pupillés de blanc, mieux indiqués." (Oberthür).

Type-locality. ". . . la Glacière de Blida . . ."

Average 30 mm.; females slightly larger than the males. Distinguishable from *fettigii* by the above-mentioned characteristics and by the presence of one or two rounds on the secondaries above.

Lord Rothschild (1925) applies the name *nicholasi* to this subspecies, the name *holli* being already preempted by the summer generation of *arcanioides*.

Biology. Undescribed.

Range. Coastal region of eastern Algeria and of Tunis.

Blida-les-Glacières (OB, RO, MCZ); Aín Draham, Tunis (MCZ).

Type. OB.

Coenonympha dorus austauti

Coenonympha dorus austauti Oberthür, 1881, 6, pp. 59–60; 1910, 4, p. 35, pl XLVIII, fig. 386; 1915, 10, pp. 361–362; Seitz, 1908, 1, p. 145; Rothschild, 1917, p. 118; 1925, p. 207.

Original Description. "Le ♂, en dessus, ressemble beaucoup à *Fettigii*, c'est-à-dire que des traits intranervuraux fauves sont placés au-dessous de la tache orbiculaire noire apicale. Dans le type de France (Cette, Florac, Nîmes) et dans celui d'Espagne (Grenade et Sierra-de-Alfakar), l'aile supérieure qui est le plus ordinairement d'un gris brilliant uniforme, ne presente que fort rare-

ment un point ou une éclaircie fauve au-dessous du rond noir apical cerclé de fauve; mais encore les individus atteints de cette éclaircie fauve sont tout à fait differents du type algérien. En dessous la ligne blanche extracellulaire est plus vive.

La ♀ est plus obscure en dessus et dessous. Les dessins sont aussi vivement accusés que dans le ♂."

Type-locality. Nemours (Algeria).

Oberthür (1915) says: "Le caractère rectiligne de l'éclaircie blanche sur le dessous des ailes inférieures est tres remarquable." And Rothschild, (1917), adds: ". . . also I find there are quite as many females as pale and with the buff quite as much extended over the wings as in *C. fettigii holli*" (*dorus nicholasi*).

Biology. Undescribed.

Range. Apparently limited to northeasternmost Morocco and the Province or Oran in Algeria. Nemours (OB, BM, RO); Lalla Marnia, Zoudj-el-Beghal, Masser Mines, Nedroma (RO).

Type. OB.

An interesting situation exists in north Africa. The majority of lepidopterists have considered *fettigii* a distinct species, but it has been shown that one can trace a complete chain of populations from Andalusia, where at times specimens occur that are very close to *fettigii* (Oberthür, 1910, 4, pl. XLVIII, fig. 392) through *inframaculata* and *fettigii* to the eastern *nicholasi*. Hence according to definition I have made these forms subspecies of *dorus* to best show their affinities.

But what of the presence of another subspecies, *austauti*, in Oranais, where *fettigii* also flies? This insect is obviously either a relict link of a once-existing chain of forms between the Iberian Peninsula and North Africa or else a mutant. It would be to unbalance the taxonomy to consider it anything but a subspecies of *dorus*, however. By definition it is perfectly permissible to have two subspecies flying in the same place at the same time as these do (Masser Mines—RO); here we have two populations that seem only physiologically isolated from each other.

Here again we have evidence of the inestimable value that life-history work would be in determining the status of doubtful forms.

Coenonympha vaucheri

Coenonympha vaucheri Blachier, 1905, p. 213; 1908, p. 216, pl. 4, figs. 1–4; Meade-Waldo, 1905, pp. 376–377, pl. XIX, figs. 1–2; Seitz, 1908, 1, p. 145, pl. 48e; Oberthür, 1910, 4, p. 45; 1915, 10, p. 362; 1922, 19, pp. 88–89; Rothschild, 1917, p. 120.

Original Description. "Ailes jaune fauve, assez largement bordées de brun noir. Les supérieures avec un grand oeil apical noir, un peu ovale et sans pupille. Les inférieures avec une série antémarginale de 4 gros points noirs également non pupillés; la bordure noire est divisée par un filet jaune, de l'angle anale jusqu'au milieu du bord marginal; par transparence des dessins du dessous, toute la partie basale paraît plus foncée, avec une éclaircie dans la cellule. Les nervures sont écrites en noir, souvent très nettement, aux quatre ailes. Frange juanâtre, quelquefois grise aux supérieures.

En dessous, les ailes supérieures sont jaune fauve dans leur moitié basale et jaunâtre dans le reste, avec une bordure brune divisée par une ligne argentée brillante; le gros oeil apical noir, bien limité, est très nettement bipupillé de blanc pur. Les inférieures, dont le dessin est charactéristique, ont toute la moitié basale d'un brun noir avec une grande tache blanche, teintée de jaune et en forme d'ovale ou de losange, qui occupe toute la cellule; vient ensuite une large bande transversale blanc jaunâtre, nettement limitée du côté de la base; le reste de l'aile jusqu'à la frange est brun noirâtre; sur ce fond se detachent les nervures, en clair, et une série de 6 ocelles pupillés, noirs, cerclés de jaune, ainsi qu'une ligne antémarginale brillante.

Cette description, faite d'après 8 ♂ et 3 ♀, se rapporte aux deux sexes; la ♀ a les ailes un peu plus larges que celles du ♂."

Type-locality. ". . . . dans l'Atlas marocain, ... "

There seems to be more variation than usual in the size of this species; the males average around 31 mm. and the females larger.

Biology. Undescribed.

Range. Locally at a high altitude in the Atlas of Morocco.

Ourika (MCZ); Tachdirt (MCZ, RO, WIEN); Tsauritz-Entsa-gautz, 9000′, Tizi Gourza, 12,400′ (Meade-Waldo—BM, RO); Tarseft Pass, Aghbalu Larbi (RO); Djebel-Oucheddene (RO, WIEN); Timhadit, Djebel Hayane (Powell—MUN); Sidi Chamarouche, Reraia Valley (WIEN).

Co-type. MCZ.

Coenonympha corinna corinna

Papilio corinna Hübner, (1803)–(1804), pl. 105, figs. 536, 537; (1805), Text, p. 40.

Coenonympha corynna Hübner, (1823), p. 65.

Satyrus corinus Godart, 1823, pp. 546–547.

Papilio (*Satyrus*) *norax* Bonelli, 1826, pp. 183–185.

Maniola corinna, Meigen, 1827, pp. 159–160.

Coenonympha corinna, Herrich-Schaeffer, 1844, 1, p. 85; 1845, pl. 60, figs. 285–286; Seitz, 1908, 1, p. 145, pl. 48f; Oberthür, 1910, 4, pp. 44–45.

Original Description. "Die Flügel oben blos nächst dem Franzenrande

sparsam braungrau angelegt, sonst rostgelb, auch nur durchscheinend geäugt, durchaus grau gefränzt; unten starker als oben rostgelb gefärbt, die Oberen mit einem ansehnlichen blass umringten Aeuggen, die Unteren braun bandirt, weiss gefleckt, mit fünf kleinen gelb umringten Aeuggen, davon eines einzeln steht, und einer glänzend bleifärbigen Linie gezeichnet."

Type-locality. "Sicilien." (?).

Average 24–26 mm., sexes alike. Oberthür says: "L'espèce varie par l'accentuation et l'envahissement, ou inversement par l'atténuation de la teinte noirâtre sur le dessus des ailes et par la présence ou l'absence, à l'apex des supérieures et le long du bord marginal des inférieures, en dessus, des points noirs cerclés de fauve. En dessous, les petits ocelles des ailes inférieures figurent quelquefois au nombre de six; mais leur nombre est souvent réduit a deux ou trois, ou même ils sont complètement supprimés, à l'exception cependant de l'ocelle costal qui paraît plus tenace. Les ocelles du dessous des ailes inférieures sont noirs, pupillés d'argent et entourés d'un cercle fauve. Extérieurement à la ligne très sinueuse, extracellulaire, descendant du bord costal au bord anal, il y a une éclaircie blanchâtre ou jaunâtre, de dimension variable. Il y a une liture marginale d'argent moins généralement interrompue aux inférieures qu'aux supérieures. Parfois l'ocelle apical est double; . . . "

Biology. Boisduval, Rambur and Graslin, 1832, pp. 5–6, pl. I, figs. 1, 2; Treitschke, 1834, pp. 57–58; Hofmann, 1893, p. 24; Bacot, 1903, pp. 94–96.

Range. Corsica, Sardinia. Concerning the possibility of its occurrence in Sicily, see the following subspecies.

Coenonympha corinna elbana

Coenonympha corinna elbana Staudinger-Rebel, 1901, p. 66; Seitz, 1908, 1, p. 145; Verity, 1910, pp. 270–271, pl. I, fig. 9; 1917, pp. 191–192; Oberthür, 1910, 4, p. 44.

Coenonympha corinna lefebvrei Ragusa, 1908, pp. 140–141; Oberthür, 1910, 4, p. 44; Gaede in Seitz, 1930, (Supplement), I, p. 176, pl. 11f.

Coenonympha corinna altera Verity, 1917, p. 192.

Original Description. ". . . al. post. supra (caeco-) ocellatis, subt. obscurioribus, ocellis majoribus, linea argentea latiore."

Type-locality. "Elba."

Sexes alike; early generation 28–29 mm., late 24–26 mm. On the upper surface of the secondaries the ocelli always show through from below as black rounds. The coloration is stronger and more marked

below than in the typical, the metallic line wider, the ocelli larger, and the buff or white band strongly marked off from the basal area which is ashy to ochre.

I have compared the specimen of *lefebvrei* from the Guenée collection figured by Oberthür, (BM), with the types of *elbana* and can observe no difference. I have seen no other *corinna* from Sicily. Oberthür (1910) says no one has found the insect in Sicily since the trip of M. Lefebvre, and as far as I can determine this is still true. But Hübner described *corinna* from Sicily, although his plate gives an excellent representation of the insect that occurs in Corsica and Sardinia. It is conceivable but improbable that both *elbana* and the typical occur in Sicily; at any rate it seems to be well established that the former does. Inasmuch as Hübner's figure so well portrays the Corsican and Sardinian subspecies, it is probable that his specimens did not come from the island of Sicily. Material from Sicily would throw light on this, but evidently the species is very rare there, if it occurs there at all.

Biology. Undescribed.

Range. The Island of Elba and possibly rarely in Sicily.

Types. STB.

Coenonympha saadi saadi

Satyrus saadi Kollar, 1850, p. 52.

Hipparchia (*Coenonympha*) *iphias* Eversmann, 1851, pp. 618–619.

Coenonympha saadi, Kirby, 1871, 1, p. 100; Romanoff, 1884, 1, p. 65, pl. III, figs. 6, 7; Seitz, 1908, 1, p. 145, pl. 48e.

Original Description. "Alis integris, supra flavis; anticis ocello geminato nigro, coeco ad angulum posticum; subtus omnibus griseo nebulosis, fascia communi media alba, intus fusco marginata, stria arcuata submarginali aurea; anticis ocello gemino coeco nigro, flavo-marginato ad angulum posticum; posticis serie ocellorum nigrorum aureo pupillatorum.—Expans. alar. 16′."

"Colore et magnitudine Sat. Pamphilo et Sat. Amarilli accedens, ab utroque vero pictura valde differt."

Type-locality. " . . . . von Südpersien . . . "

The males are the color of the summer form of *pamphilus lyllus*, a pale yellow ochre, and average 27 mm.; the females are very slightly lighter and larger. The large, blind ocellus at the posterior angle (double in this subspecies) is characteristic. The metallic marginal line is well developed.

Biology. Undescribed.

Range. From Transcaucasia and Armenia southeastward into Persia. Ordubad (USNM); Eriwan (OB, BER); Egin, Armenia (STB); Demavend, 2500 m. (RO); Scharud (BM, STB); Harir, Maidan-i-Naphtun (BM).

Coenonympha saadi mesopotamica

Coenonympha saadi mesopotamica Heyne in Ruhl, 1894, p. 617; Seitz, 1908, 1, pp. 145–146.

Original Description. "Beiderseits blasser und weniger scharf bezeichnet als die Stammart. Auf der Vorderflügeloberseite tritt von den beiden Augenpunkten der untere etwas auf, wahrend der in Zelle 3 ganz fehlt oder nur schwach angedeutet ist. Auf der Unterseite ist der Augenpunkt in Zelle 2 sehr scharf und deutlich, der in Zelle 3 aber kaum angedeutet; beide werden wie bei der Stammart gemeinschaftlich blassgelb umgeben. Alles übrige ist wesentlich blasser als bei *Saadi*, besonders die bleiglänzende Linie ist stark reduziert, namentlich auf der Vorderflügeln, woselbst nur eine schwache, dunkle Linie ihre Stelle bezeichnet."

Type-locality. Mesopotamia.

Distinguished from the preceding by the fact that the anterior of the two blind ocelli at the posterior angle of the primaries has become obsolete and by its generally lighter color.

Biology. Undescribed.

Range. The only specimens or records I have seen were from Mardin, Mesopotamia (MCZ, BM, STB).

The Pamphilus Complex

To all those familiar with the Lepidoptera of the Old World *pamphilus* presents an extremely fascinating problem. Before dealing with its taxonomy and that of its subspecies I wish to digress slightly to show the complexities and magnitude of the problem involved.

In the first place we are dealing with one of the most variable species within narrow limits, of the genus and one that presents a more difficult problem to the taxonomist than any other, with the possible exception of *arcania* and its forms. A great deal has been written about *pamphilus* and its variation; out of the welter of so-called "races" described by my predecessors I have attempted to visualize certain large fairly well-defined populations which I consider subspecies.

Marston Bates (1935, p. 75) says:

"There are many cases of purely phenotypic changes in animal populations corresponding to changes in environment over the range of the species . . . As an example . . . we may take the North American butterfly, *Papilio glaucus*. Clark (1932, p. 184) maintains

that the form described as *Papilio glaucus canadensis*, which occurs over the northern part of the species range where there is but one generation a year, corresponds to the spring form of the species in more southern localities, as in the District of Columbia. If this is true, and if the characters of the Canadian form and of the southern spring form are phenotypic, the result of temperature, then *canadensis* might be called a *pseudochoromorph*." This case is parallel with that of *Coenonympha pamphilus*.

It has been seen that his term choromorph is synonymous with the subspecies of most entomologists. His proposed term, pseudochoromorph, would imply that there is a distinction between this situation and that of two subspecies as defined. This distinction we must admit. Strictly by definition we should not consider a northern form a subspecies distinct from a southern form the only difference in which is its tendency to produce a summer brood of different appearance. But to avoid complication it would be best to liberally interpret our definition of subspecies so as to include this situation. We have *two* populations separated from each other by temperature (and possibly other) barriers but merging imperceptibly as do continental subspecies in the regions where the areas they occupy impinge. The only heritable morphological characteristic distinguishing the southern population from the northern is its tendency to produce a distinct summer brood. It seems very doubtful to me that by controlled breeding of *pamphilus pamphilus* of northern Europe in a warm environment one could produce a light-colored "summer" form as *lyllus* does. I believe that the tendency to produce this light form is inherent in the southern stock and not in the northern.

Of the many papers that have been written on this variable butterfly I consider Verity's "The geographical and seasonal variations of *Coenonympha pamphilus* L." (1926) the most expert. His work shows a very complete knowledge of the variation in this interesting insect throughout its range; future work to determine the accurate ecological and biological status of his "races", which can be done by breeding and by breeding alone, must refer back to his knowledge of its variation. I was unfortunate in being unable to visit Italy to see Dr. Verity's extensive series during my trip to Europe in the summer of 1936; I have, however, seen series of the majority of the "races" he has described in other collections. On the basis of what I have seen, I strongly differ with him on several points. Let us consider his paper.

He says: "I have in some of my articles already remarked how sadly neglected this species usually is by collectors and how, in consequence,

the literature about it is of the poorest description and very little is known about its variations. The cause, no doubt, lies in the fact the species is nearly ubiquitous and inconspicuous, so that collectors are not keen to pay for specimens and take no interest in it, thinking those they can find near their door-step are similar to all the others. This is an entirely mistaken idea and Oberthür, like myself, has pointed out that, on the contrary, *pamphilus* is one of the most variable and interesting species. I maintain it is one of the broadspread and common species, which will furnish the most valuable data from the general standpoint of evolution, the very object we are endeavouring to achieve by the long, toilsome work of careful analysis carried out along the lines of an orderly synthetic plan. As I have struck in *pamphilus* a nearly unbeaten track, I am responsible for most of the descriptions and names and some of those who will have the patience of glancing through the following pages may think I have pushed analysis too far. I feel confident, however, that if the matter is gone into fully, with sufficient materials at hand to verify my statements, it will become obvious I have only been led by very positive facts and it would have been a mistake to deliberately limit our knowledge through fear of following nature's complex developments. As to the number of names, I cannot go into the long-debated question here, but I can mention the excellent example afforded in this very species by that of *lyllus* Esper, showing the errors that arise from insisting on using existing names in cases, which are, in reality, entirely different and new and require a new designation. The descriptions of it given by many of the most diffused text-books deal with forms which have nothing in common with Esper's insect and in nearly every local list of butterflies, including Britain, one finds it recorded. Esper's *lyllus* is, instead, so distinct from *pamphilus* that lately it has been suggested by myself and by Querci it might even be a distinct species (see Entomologist's Record and Journal of Variation, respectively of 1916, p. 171, and of 1925, p. 26). This hypothesis is worth considering, although the facts I have been able to observe so far are not in favour of the conclusion that there exists sterility between *lyllus* and *pamphilus*, such as is essential in true specific distinctness."

I doubt that it is generally accepted that sterility *is* essential to true specific distinctness in animals.

To continue, he says: "On the other hand the statement made by Turner, according to the general belief, that *lyllus* is nothing but the hot dry season form of *pamphilus* and that the latter must necessarily precede it in the spring, is not correct either. True *lyllus* is perfectly

distinct at all seasons, although the features of the I generation are much less striking at first sight than those of the II. Thus, neither of these views fits facts exactlyand I think the truth must be sought for in a third phenomenon, the one I have described as "exergism" or "exclusivism" in the Entom. Record, 1925, p. 103. In dealing with the *Zygaenae* I have pointed out that it is impossible to limit our knowledge of relationships to specific and racial ones."

With this last statement I agree. We cannot limit our knowledge, but we *must* limit our naming of the forms which, as we shall see, Verity calls "races."

Continuing, he says: "There exists at least one other kind, in which two groups possess different hereditary features, but are not sterile to one another, so that when they meet they interbreed and they only keep distinct because their constitutions are suitable to different surroundings and usually keep them apart from each other. It will thus be necessary to work out relationship more accurately than has hitherto been done and establish in each case of groups differing from each other the sort of distinctness they exhibit. It is, however a mistake to attempt to judge the degree of distinctness from the fact that the features are more or less striking, as has been done too often in the past. Even one of the most thorough and clever entomologists has sent me photographs of "genitalia" and asked me to give my opinion as to whether they were specifically distinct or not. My answer is that any kind of morphological difference can be suggestive of specific distinction, but none can be conclusive as to its existence. To my mind it is only on sterility between two groups one can base specific distinction, independently of all visible features. Practically one is, of course, obliged to make use of the latter to distinguish the individuals of the two groups, but one can only come to a definitive conclusion either by experimental breeding of more than one generation, to exclude the grades of fertility capable of producing hybrids during as many as three or four successive ones, or by inferences drawn from the following observations: When two groups, distinguishable by some feature, live together in some regions and no transitional individuals are met with, we can conclude they are in reality specifically distinct. When two such groups inhabit different areas and replace each other entirely, never producing each other's features, even as extreme individual variations, but they obviously interbreed where they meet along the boundary of their areas as shown by transitional individuals found in that zone only, we must conclude we have before us a case of exergism, such as I have defined above."

Quite obviously this last definition, of exergism, differs from the concept of subspecies or race of most biologists only in the phrase "never producing each others' features." We do not generally tie ourselves down as hard because we can conceive of, and indeed at times see, two genetically distinct populations which at times produce each other's form. Then Verity says:

"When on the contrary, two groups inhabit different areas and are on the whole different in aspect, but one, or both, produce individuals transitional and similar to those of the other group in all or most localities, so that evidently the differences are only due to the direct effects of local conditions on the individual development and the center of oscillation of variation is not modified permanently in an hereditary way," (*is not genetic*) "we must speak of races."

On this basis Verity names his "races", and herein we have chaos because there is no way from the above definition to maintain our concept of genetically constant populations.

I must admit that in such a variable species as this we have "groups of individuals" that fit Verity's definition of race. To maintain names for these "groups of individuals" as Verity does until we have moved them up into a higher subspecific (exerge) status and by breeding have determined that the small differences on which they are based are constant is to unbalance the taxonomy.

It can easily be seen that breeding alone will determine the status of many forms of *Coenonympha*, particularly those of this species. Transferring some forms to different types of environment and breeding them over several generations, keeping careful note of the changes brought about, would probably produce very interesting results, but many entomologists would be unwilling to devote as much time as would be necessary to do this. It would seem, however, that this is the only way in our power of ever arriving at a knowledge of what the forms are.

However, for the time being let us limit our naming to populations that we at least consider genetically distinct from each other. Let us not regard *any* taxonomic treatment of such species as anything but tentative until we have carried out extensive breeding experiments.

Concerning the possible history of *C. pamphilus* Verity sets forth some hypotheses:

"A few interesting inferences can be drawn from the variations and distribution of these *Coenonympha,* which confirm those I have drawn from the genus *Zygaena,* because they evidently follow exactly the same lines of evolution. The three broader groups *thyrsis, lyllus* and

pamphilus are obviously successive grades, on the whole, of a single line of variation and probably of descent. If we take into account the remarkable transitional look of the oriental (Mesopotamia to Persia) species *C. saadi,* Koll., between the type of pattern of *thyrsis* and that of the Australian *Hypocrysta,* we are lead to conclude that *thyrsis* is probably the most ancient living form of the *pamphilus* line of descent. Certain points of a distant resemblance to *corinna* and to *vaucheri,* not to mention *dorus,* gives one the impression that it was the form of *pamphilus* which flew in company with them before the Glacial epoch and during the hot Interglacial periods, whilst during the periods of glaciation it only survived under that form in southern parts of the Palaearctic region. Further north its constitution evolved into a state of organic balance suited to stand cold climates and succeeded in producing an extreme one capable of living even in as cold ones as that of northern Finland is in our times, whereas, *corinna* and *vaucheri,* and to a lesser extent, also *dorus,* had no power of evolving that way and they had to retire southward and localise where conditions were suitable to their particular requirements. In fact, also individually, they vary very little, as compared to *pamphilus,* showing that they are highly anabolic, and in a very fixed and specialised state, uncapable of much physiological reaction to changes of surroundings. The oldest exerge *thyrsis* of *pamphilus* may be in comparatively similar conditions. It cannot have the same hereditary factors as *lyllus* or the latter would in this case, produce it occasionally, at least as an extreme individual variety, whereas form *thyrsides* Stdg. is its nearest approach in this direction. In our times the climate of the Palaearctic region has evidently drifted too far from that of the tropical ones and *thyrsis* is on the verge of following its ancestors of those days into extinction. The two centers of oscillation of *lyllus* and of *pamphilus* are now left alone to fluctuate respectively from south to north and from north to south and replace each other according to the minor climatic variations of different Epochs."

Coenonympha pamphilus pamphilus

Androconia—fig. 16.

Papilio pamphilus Linnaeus, 1758, Ed. X, p. 472; 1761, p. 273.
Papilio menalcas Poda, 1761, p. 68.
Papilio procris Geoffroy, 1764, II, p. 53.
Papilio nephele Hufnagel, 1766, p. 78.
Coenonympha pamphile Hübner, (1823), p. 65.

Satyrus pamphilus, Godart, 1823, pp. 549–550.
Maniola pamphilus, Meigen, 1827, p. 153.
Hipparchia pamphilus, Stephens, 1828, p. 69.
Coenonympha pamphilus, Herrich-Schaeffer, 1844, 1, p. 84; Seitz, 1908, 1, p. 146, pl. 48g; Oberthür, 1910, 4, pp. 46–49; Rothschild, 1917, pp. 119–120; Turner, 1923–24, pp. 39–54; Verity, 1926, pp. 191–208; Gaede in Seitz, 1930, (Supplement), 1, pp. 177–178. (etc.).

Original Description. "Descr. Rai descriptio bona est. Alae suprae fulvae margine subfusco, subtus cinerascentes; Ocellus in ala primaria subtus unicus est et niger puncto albo annuloque nigro. Alae secundariae subtus cinereae; antice obscuriores; in medio fascia pallida et ocellis obliteratis quatuor notatae." (Linnaeus, 1761).

Type-locality. "Sweden."

The males average 27–28 mm., females slightly larger and lighter. Ochre above with narrow grey margins and pale fringes; the markings show through from below. The primaries are ochre below with a single apical ocellus, greyish apex and a trace of a pale wavy band behind the ocellus. The secondaries are ashy-brown to grey, the proximal half darker than the distal half and separated from it towards the costal border by a pale wavy band that varies in extent and brightness or may not be present at all. There are traces of submarginal ocelli, generally merely vague brown rings, varying in number. The basal area is more or less slaty-hairy.

Turner (1923) says: "In 1758 Linné, 'Sys. Nat.,' ed. x., Vol. II., p. 472, describes and names this species as 'Papilio Danai alis integerrimis fulvis: subtus primoribus ocello unico; posticis fascia alba.'

"His references are to (1) his own 'Fn.suec.,' 1746, where it was called *tityrus;* (2) Petiver's 'Musei'; (3) Ray's 'Hist. Ins.'; (4) Mad. Merian's 'Europ. Ins.'; and to Rösel's 'Ins.,' and leave no doubt as to identification."

Biology. Ochsenheimer, 1807, 1, p. 307; Godart, 1821, p. 177; Duponchel, 1849, 1, pp. 204–205, pl. XXX, fig. 86 a-d; Wilde, 1861, p. 38; Hofmann, 1893, p. 24, pl. 5, fig. 17; Klokman, 1904, Ent. Ber. Nederland, 1, p. 134; Lempke, 1926, Levende Natuur. Amsterdam, 31, pp. 220–222.

Range. Northern and central Eurasia generally between the 45th and 66th parallels. In southern Europe it merges imperceptibly with the following subspecies that show a distinctly colored summer form: *lyllus* of southernmost France, Spain, Portugal and north Africa, *australis* of Italy and *marginata* of Hungary and the Balkans.

Herr Nordström (1935) described *pamphilus winbladi* from Hapa-

randa in northern Norrbotten. Unfortunately I have not seen enough *pamphilus* from this far northern region to determine whether they are distinct enough to consider a good subspecies. Aurivillius (1888) evidently had seen Norbotten specimens, but mentions no difference in them.

The typical insect extends into Asia in western Siberia, Transcaspia, Russian Turkestan, Sinkiang, Semiretchensk and the Altai Range. I have seen specimens from the following localities in Central Asia where in southern localities occasional specimens occur that approach the appearance of the summer form of *lyllus:* Kainsk (RO); Omsk (STB); Altai Mts. (MCZ); Samipalatinsk (MCZ); Semiretchensk (OB); Ili region (BM, MUN); Issyk-kul (RO); Alexander Mts. (STB); Ala-tau Mts. (MUN); Tian-Shan Range (STB, MUN); Margalen, Namangan, Samarkand (BM, STB); Kashgar, Ferghana, Serafschan Mts. (BM); Tekkes (CAR).

Types. LS? Concerning the specimens in the Linnean Society in London which I was fortunate enough to visit in the summer of 1936, Dr. Verity (1913) says: "Two Linnean specimens of the small northern race, with hind wings dark on the underside and bearing a well-marked white band." Whether or not these are the valid types, these specimens and specimens from Scandinavia in general (Aurivillius, Nordström and Wahlgren etc.) do not seem regularly distinct enough from those of central Europe to warrant the use of a later name for specimens from the latter region.

Coenonympha pamphilus scota

Coenonympha pamphilus scota Verity, 1910, p. 271; 1916, p. 171; 1926, pp. 204–205; Gaede in Seitz, 1930, (Supplement), 1, p. 177.

Original Description. "The race of *pamphilus* from the British Isles differs substantially and constantly from that of the continent; the greatest development of this insular race is found in Scotland. The most outstanding and constant characteristic is the development of the white band of the lower side of the hind wings, which is brought out by the dark background, especially in the basal part of the wing which stands out from the rest, which is clearly lighter; the brown shadings are outstanding and help to give the wing a very variegated appearance; the light band on the lower surface of the anterior wings is also remarkable and in some specimens it is very broad and very white, surrounding the apical ocellus." (Trans.)

Type-locality. ". . . from the north coast of Scotland . . ."

I believe Verity's name *scota* to be the first applied to the British population as distinguished from the Continental one.

Biology. Buckler, 1886, pp. 172–173, pl. VI, fig. 4.; Frohawk, 1924, pp. 33–37, pl. 41.

Range. The British Isles. Channel Island specimens (Jersey—BM) seem to belong to this distinct island subspecies.

Coenonympha pamphilus lyllus

Androconia—fig. 17

Papilio pamphila, Hübner, (1803)–(1804), pl. 109, figs. 557–558; (1805), Text, p. 40.

Papilio lyllus Esper, (1805), Supplbd., II, pp. 23–24, pl. CXXII, fig. 1.

Coenonympha lylla, Hübner, (1823), p. 65.

Satyrus lyllus, Godart, 1823, pp. 548–549.

Maniola lyllus, Meigen, 1827, pp. 153–154.

Coenonympha lyllus, Herrich-Schaeffer, 1844, 1, p. 83; 1849, pl. 90, figs. 430–431.

Coenonympha pamphilus lyllus, Seitz, 1908, 1, p. 146; Oberthür, 1910, 4, p. 48; 1915, 10, pp. 363–364; Verity, 1910, pp. 271–272; 1914, pp. 226–227; 1916, p. 172; 1919a, pp. 121–123; 1926, pp. 191–208; Rothschild, 1917, pp. 119–120; Gaede in Seitz, 1930, (Supplement), 1, pp. 177–178. (etc.).

Original Description. "Die Grundfarbe der Aussenseiten ist von einem mehr erhöheten Ockergelb, der äussere Rand aber an den Vorderflügeln schwarz gesäumt, und an den Hinterflügeln, wo der P. Pamphilus nur weissgraue Flecken hat, sind sie hier mit schwarzen spitzwinklichten gesäumt. Die untere Seite der Vorderflügel hat zwar gleiche Augenmackeln wie jener, durch die Mittenfläche aber ziehet sich ein, rostfärbiger, schmaler, etwas ausgeschweister Streif, der jenem mangelt. Den beträchtlichsten Abstand ergiebt die Unterseite der Hinterflügel. An dem P. Pamphilus bestehet sie aus einer dunklen Mischung von Braunem und Grünlichem mit eingestreuten grauen Atomen vermengt. Hier ist sie von blassem Ockergelb, und gegen die Grundfläche mit braunen Atomen bestreut. Diese dadurch etwas mehr verdunkelte Fläche, ist in der Mitte durch eine dunkelbraune abgesetzte kappenförmige Linie begränzt. Unser Pamphilus hat in gleicher Entfernung des äussen Randes, eine Reihe kaum sichtlicher weisser Punkte, auf verlohrenen bräunlichen Flecken. Hier hingegen sind die Augenmackeln um so grosser gebildet, und verzüglich nehmen sich die drei mittlere aus. Diess giebt einen wesentlichen Abstand, und man wird nicht die Anzeige von mehreren Abweichungen fordern. Der weibliche Falter soll in den zeichnungen keine Verschiedenheit ergeben . . ." (Esper, 1805).

Type-locality. "Portugal."

Esper describes and figures the summer form of this subspecies, and Tutt (1923) says of it: ". . . the marginal band of the upper side (is) divided into a marginal and premarginal one by a narrow stripe of the

ground color, this is more prominent on the under side . . ." This is also at times true of the spring and fall forms, which are scarcely distinguishable from *pamphilus* of the north. Oberthür says that in the most southern part of its range (Algeria) even winter specimens show a tendency towards the buff tinge characteristic of the summer form. Verity (1916) says: "In the spring brood the characters which differentiate *lyllus* from *pamphilus* are much less conspicuous, but a careful observer can detect they are just as constant: besides the double marginal band of the upper side, and the more prominent median streak of the underside of the forewings, it must be noticed that the basal half of the hind wings on this surface is very dark, contrasting with the much lighter outer-half, somewhat as in *scota* Verity, but with no white band, or a very inconspicuous one; the ocelli tend to be more developed and more numerous than in *pamphilus* . . ."

Biology. Evidently never described in direct comparison with the northern insect. Extensive breeding experiments would be extremely interesting.

Range. Southernmost France, Corsica, Sardinia, Spain, Portugal and the northwest coast of Africa from Morocco to Tunis. In the heterogeneous population of Asia Minor, this insect flies with *australis* and *marginata* forms (Rhodes—BM), but in some localities *lyllus* flies alone (Beyrut, Hadeth, Afka—Syria, BM).

Coenonympha pamphilus australis

Coenonympha pamphilus australis Verity, 1914, p. 227; 1916, pp. 173–174; 1919b, pp. 71–72; 1926, p. 201; Gaede in Seitz, 1930, (Supplement), 1, pp. 177–178.

Original Description. ". . . the yellow of the upper surface is darker and brighter than that of the Linnean race, the black border narrow and clear, the fringes shorter and not so white; on the lower surface the white band does not appear on the primaries or in the females it is only slightly visible towards the costa; the secondaries are of a uniform color from the base to the external margin and they have nearly a velvety look; they are of a light gray with a dim greenish coloring which tends at times towards light blue, at others yellowish; the ocelli, if they exist, and the rings that surround them, are indistinct and the wavy line between the ocelli and the margin is indistinct; the white band, which is very narrow, is only visible in the costal area, has diffused edges, and its coloring is of a dirty white or yellowish. In the beginning of the spring and in the latter part of autumn specimens can be found with a very dark under surface of the secondaries, sometimes even blackish with a light blue tinge towards the base and inner margin, and with no trace of the white band in the extremes." (Trans. from the Italian).

Type-locality. ". . . from the hills of Macerata, m. 300 (Piceno) . . ."

Verity describes the spring and autumn form. The summer form is hardly distinguishable from that of the subspecies *lyllus;* the ochre is darker and richer, as well as the lower surface.

Biology. Undescribed.

Range: Hungary, the northern Balkans, the Italian Peninsula and Sicily.

Coenonympha pamphilus marginata

Coenonympha pamphilus marginata Heyne in Ruhl, 1894, p. 619; Seitz, 1908, 1, p. 146, pl. 48g; Oberthür, 1910, 4, p. 49; 1922, 19, I, p. 89; II, pl. DXXXI, fig. 4417; Verity, 1926, pp. 200–202 (partim); Gaede in Seitz, 1930, (Supplement), 1, p. 177.

Original Description. "Oberseite mit breitem, schwarzbraunem Aussenrand und sehr lichter Grundfarbe. Unterseite meist scharfer als bei *Lyllus* gezeichnet."

Type-locality. "Kleinasien."

This subspecies is as variable as *lyllus* and is distinguishable only on the basis of its wide dark margins. This characteristic is nowhere absolutely regular, but the tendency to develop more or less heavy margins, particularly in the summer generation, is marked throughout the range of this population.

Biology. Undescribed. Here again experiments would be of much value.

Range. Greece, the Aegean region with the exception of Crete, Asia Minor to Armenia.

The status of the well-known form *thyrsides* Staudinger-Rebel, (1901, p. 66), can only be determined by breeding. Concerning it Turner (1923) says: "Staudinger's 'Cat.,' p. 66, no. 440c., gives the name *thyrsides,* to Herrich-Schaeffer's fig. 430–431, and adds 'al. post supra subtusque 3–4 ocellis parvis nigris vel-albido pupillatis.' with localities Sicily, Dalmatia, Syria, Tura, Taurus. Her. Sch. Says: '*lyllus* to *C. thyrsis;* the upper side was very similar to fig. 299 (*thyrsis*), the fringes whiter, the brown band of the margin of the hind wing not so toothed. Below the silvery marginal line was wholly wanting'."

The name *thyrsides* is misleading. The insect should not be thought of as being any more closely related to *thyrsis* than any other *pamphilus*-form; it is most certainly only a variant of the summer forms of the subspecies of the Mediterranean Region.

The following "race" and seasonal-form names have been proposed,

for the retention of which, as far as I can determine, there is absolutely no good reason:

londinii Vty.
postlondinii Vty.
centralis Vty.
postcentralis Vty.
emiaustralis Vty.
postaustralis Vty.
postemiaustralis Vty.
murina Vty.
latecana Vty.
infraaestivalis Vty.
bipertita Vty.
barcinonis Vty.
postbarcinonis Vty.
foeda Vty.
emilyllus Vty.
latenigrata Vty.
ferrea Vty.
postferrea Vty.
antelyllus Vty.
arenosa Vty.
atlantea Vty.
latevittata Vty.
gigas Vty.
lyllides Vty.
detersa Vty.
torrida Vty.
nitidissima Vty.
fulvolactea Vty.
centralasiae Vty.
postcentralasiae Vty.
juldusica Vty.
infrarasa Vty.
asiaemontium Vty.
euxina Vty.
posteuxina Vty.
semilyllus Krul.
thanatos Std.
galvagnii Std.
nigrita Std.
ferghana Std.
maritima Std.
hispana Stf.
aestivalis Rocci
sicula Z.
orantia Frhs.
winbladi Nrds.

Coenonympha thyrsis

Androconia—fig. 18.

Hipparchia thyrsis Freyer, 1845, 5, p. 157, pl. 475, fig. 1.
Coenonympha thyrsis, Herrich-Schaeffer, 1846, 1, pl. 62, figs. 297–300; 1851, 6, p. 18; Staudinger, 1870b, p. 80; Seitz, 1908, 1, p. 145, pl. 48e; Rebel, 1916, pp. 112–114, fig. 3, (genit.); Verity, 1926, pp. 195–196. (etc.).
Coenonympha pamphilus cretica Standfuss, 1855, pp. 158–159.

Original Description. "Es hat dieser Falter die Grösse und auch die Farbe von unserem gemeinen Pamphilus. Die Oberflügel führen an der Spitze ein dunkles Auge und sind vor den gelbgrauen Franzen schwarzbraun gesäumt, welcher Saum durch eine feine Linie der Grundfarbe von solcher getrennt ist und beim Weibchen blässer sich zeigt. Die Unterseite kommt mit Dorus genau überein. Die Hinterflügel führen ebenfalls 6 kleine Augen in einem Halfkreis, nur dass hier die Grundfarbe von der Wurzel bis zur weissen Mittelbinde am Rande in braune Flecken sich verliert, welche gegen diese weisse Binde schärfer abstechen. Das Auge auf den Vorderflügeln ist hier goldgelb

eingefasst und führt im schwarzen Mittelpunkt eine weisse Pupille. Das Weibchen führt ganz die Farbe und Zeichnung des Mannes, nur ist es bedeutend grösser. Die Fühler sind schwarz und weiss geringelt mit kleiner Kolbe."

Type-locality. ". . . auf der Insel Creta . . ."

The males average 24 mm., females slightly larger. Freyer does not mention the well-developed marginal metallic line on both primaries and secondaries below.

I agree with Rebel's statement (1916): "Die von Freyer zuerst angenommene nahe Verwandtschaft von *C. thyrsis* mit *C. dorus* Esp. und *C. corinna* Hb., welche von den meisten späteren Autoren, so auch von Herrich-Schäffer (VI, p. 18) wiederholt wird, ist ganz unbegrundet."

The insect seems to take the place of *pamphilus* in Crete; the distinctly shaped androconial scales (fig. 18) separate this species from all other Coenonympha, but show it to stand closest to *pamphilus* (fig. 15). I see no more evidence for Verity's (1926) belief that this is the most ancient representative of the *pamphilus* line than for the possibility that it is a recent mutant occurring in Crete; the androconial scales seem more advanced than those of *pamphilus*.

Biology. Undescribed.

Range. Prof. Rebel (1916) says: "Uberall auf Kreta verbreitet, mit einer oberen Höhengrenze von beiläufig 1400 m. Seehöhe."

Coenonympha mongolica

Coenonympha mongolica Alpheraky, 1881, p. 426, pl. XV, fig. 26; Seitz, 1908, 1, p. 147, pl. 48h; Wagner, 1913, p. 245. (etc.).

Original Description. "C'est la la plus grande *Coenonympha* que je connais. En dessus, les ailes sont d'un gris-cendré bleuâtre avec le limbe externe large, d'un gris-fuscescent, qui se confond graduellement à l'intérieur des ailes avec la couleur du fond.

Ce limbe, qui longe tout le bord extérieur des premières ailes, n'occupe que le bord antérieur des deuxièmes. Des points ronds, antimarginaux, d'un blanc un peu grisâtre; sont placés plus à l'interieur du limbe: l'apical étant le plus grand, aux antérieures, est toujours muni d'un point noir central. Les autres points blancs, disparaissent presque complêtement sur ces mêmes ailes, chez quelques individus. Aux postérieures il y a, en général, plusieurs de ces points qui sont munis de centres noirs; notamment ceux des 2^{me} et 3^{me} cellules le sont toujours très distinctement.

La frange des premières ailes est de la couleur du fond extérieurement, tandisqu'elle est d'un gris-fuscescent dans la partie adhérente au bord de l'aile. Chez tous les individus que j'ai devant moi en ce moment, je remarque une raie marginale couleur de plomb, qui long le bord extérieur des deuxièmes ailes; elle est plus nettement accusée chez quelques uns.

En outre, quelques individus ont la côte des antérieures teintée de jaunâtre ou de brunâtre très clair.

Le revers des premiers ailes est d'un gris-sale, tandisque les postérieures sont d'un gris brunâtre.—jaunâtre, voir même verdâtre chez quelques individus.

Ce n'est qu'au dessus de l'angle interne des premières ailes, qu'on remarque une ombre foncée (noirâtre) peu large, qui s'efface chez d'autres individus et qui correspond à la partie intérieure du limbe du dessus.

Deux lignes parallèles, l'une marginale, l'autre submarginale longent le bord extérierur de toutes les ailes.

Ces deux lignes, dont l'interne est toujours argentée, tandisque l'externe (qui l'est aussi quelquefois) est généralement couleur de plomb, ont l'espace compris entre elles, d'un jaune-ocracée pale. mais toujours distinctement visible. Les points antimarginaux, que nous avons vus sur le dessus, se retrouvent également sur le revers; ils sont ici mieux accusés, mais ont une autre apparence, notamment aux ailes postérieures, où ils forment une série complête, c.ad. qu'il se trouve un point entre chaque deux nervures. Ces points ronds, sont petits, noirs, centrés de blanc et cercles de jaunâtre. Aux premières ailes les points ont une grande tendance à disparaître, et il n'y a guère que l'apical qui soit constant et bien net. Ce dernier est également rond, grand, cerclé de jaunâtre et pupillé de blanc. Il est place dans la V cellule, à compter du bord interne.

Aux secondes ailes nous voyons en outre un trait longitudinal blanchâtre, situé immédiatement après la cellule discoidale et s'appuyant sur la IV nervure. Ce trait s'arrête avant le point antimarginal et commence, quelquefois, dans la cellule-discoidale même.

Le thorax, l'abdomen, etc. sont de la teinte bleuegrisâtre des ailes. Les antennes sont brunes, annulées de blanc en dessus et blanches en dessous."

Type-locality. Kuldja.

Range. Ili region (BM); Kuldja (MCZ, BM, STB); Dzarkhent, Semiretchensk Dist. (MCZ, STB); Alexander Mts. (BM).

THE SEMENOVI GROUP

Coenonympha semenovi semenovi

Genitalia—fig. 26

Venation—fig. 7

Coenonympha semenovi Alpheraky, 1887, in Romanoff, 3, pp. 405–406; 1889b, in Romanoff, 5, pp. 82–83; 1889a, l.c. p. 118, pl. IV, fig. 7; Heyne in Ruhl, 1894, p. 623; Seitz, 1908, 1, p. 147, pl. 48i.

Original Description. "♂ ♀ 25–26 mm.

Supra dilutissima brunnea, ciliis albidis, ♂ alis anticis orbiculo (puncto) apicali albido, posticae serie antemarginali orbiculorum albidorum, ♀ supra dilutior, orbiculis vix conspicuis; subtus anticae ut supra, posticarum pagina

interna virescenti grisea,—externa maculis magnis orbiculisque antemarginalibus albis."

Type-locality. ". . . de la chaîne Bourkhane-Bouddha (Tsaidame) . . ."

The typical subspecies is characterized by the light brown of the males and the whitish appearance of the females. In both sexes the proximal half of the lower side of the secondaries often strongly contrasts with the distal half and is ashy-black; the base is slaty-hairy. This subspecies is not as common in collections as *leanotchka* of Szechuan, which many mistakenly consider the typical of Alpheraky.

Biology. Undescribed.

Range. Northeastern Thibet and Kansu. Sinling (MCZ); Tatung (CAR); Richthofen Mts. (CAR); Amdo (MUN, BM); Kuku-nor Region (RO, BER, STB, MUN).

Coenonympha semenovi leanotchka

Coenonympha semenovi, Leech, 1892, p. 96, pl. XI, fig. 4; Draeseke, 1925, p. 57. (etc.).

Coenonympha semenovi obscura Alpheraky, 1897c, in Romanoff, 9, p. 111.

Coenonympha semenovi leanotchka Hemming, 1933, p. 275. (nom. nov.)

Coenonympha semenovi szechwana Bang-Haas, 1934, p. 110.

Original Description. Alpheraky (1897). "Un ♂ de Tâ-tsien-loû, pris en Juin, diffère beaucoup des individus originaux du Tsaidam et de ceux de Myn-dyn-cha (Amdo), rapportés en nombre par M-r Groum-Grshimailo, par sa plus forte taille et par sa coloration brune plus foncée . . . . . et c'est un individu de cette forme . . . . que figure dans son grand ouvrage M-r Leech. Je noterai pourtant que le sujet rapporté par M-r Potanine est encore plus grand et d'un brun plus riche que ne l'est l'individu figuré par M-r Leech." (Alpheraky, 1897).

Type-locality. Tatsienlu, Szechuan.

Slightly larger than the preceding (averaging 29 mm.) and far commoner in collections, this southern subspecies is characterized by the dull grey-brown appearance of the males, not as light as the brown of *semenovi* nor as rich as the brown of *arnoldi.* The females are lighter than the males above and below but have the same dull tinge. There is much variation, however, for males occur as light as most females and females as dark as most males.

Hemming (1933) proposes the name *leanotchka* for *obscura,* which "is invalid as it is a homonym of *Coenonympha leander* Esp. var. *obscura* Heyne (1894, in Rühl . . .)."

Biology. Undescribed.

Range. Eastern Thibet and Szechwan. Tatsienlu (MCZ, OB, BM, STB); Sungpan, Nr-tang-gu (USNM); How-kow (BM, STB); Siao-lou (OB); Pu-tsu-fong (BM, STB); Yu-long-gong, Wali, 11200′–12000′ (RO); above Tailing to 14000′ (RO); Kuan-chiai, 13700′ (RO) = Yin-kuan-tsai? (USNM); Kunkalashan (RO, MUN).

[Coenonympha semenovi arnoldi]

Coenonympha semenovi arnoldi Bang-Haas, 1934, p. 110.

Original Description. "Die Farbung ist in beiden Geschlechtern 12 ♂ 2 ♀ kupferbraun wie *iphis* W.—Oberseits Vfl. das Apicalauge und Hfl. 4–6 Randmonde sind mit Ausnahme von 3 ♂ ♂ verdunkelt und nur undeutlich sichtbar."

Type-locality. "Kuku nor mer. or. Alt Tau, Hsi king shan, . . ."

In many collections there are series showing a complete transition from the nymotypical subspecies to this dark form. Its status I cannot definitely establish, but it seems to occur sporadically over the range of the species. In some localities it seems regular. More collecting and breeding experiments are necessary; it is doubtful, however, that the form deserves subspecific status.

Samtsa Lake, Mi-chi in the Yu-long-si Mts. (CAR); Chone (MCZ, CAR); Tatsienlu, Jedo Pass (USNM); Hsi-king shan (STB).

Types. STB.

THE HAYDENII GROUP

Coenonympha haydenii

Fig. 39.

Palpus—fig. 22

Genitalia—fig. 25

Venation—fig. 6

Erebia haydenii Edwards, 1872, p. 467; 1897, 3, p. 251 (♂).
Coenonympha (Erebia) haydenii, Skinner, 1897, p. 156 (♀).
Coenonympha haydenii, Skinner, 1900, pp. 308–309, pl. VII, figs. 17, 18.
Coenonympha haydeni Weymer in Seitz, 1911, 5, p. 227, pl. 50b; Holland, 1931, p. 186.

Original Description. "Male: expanse, 1.6 inches.

Upper side fuscous, immaculate; under side a shade paler, much irrorated with gray scales; primaries immaculate; secondaries have a complete series of black ocelli along the edge of hind margin, one in each interspace; each ocellus narrowly ringed with ochraceous, and having minute white pupil." (Edwards, 1872).

"♀. This differs markedly from the male in being entirely different in color. Males are dark smoky-brown, and the females are nearly same color as *Coen. inornata* but not so reddish." (Skinner, 1897).

Type-locality. Yellowstone Lake, Wyoming.

Neither Edwards nor Skinner mention the fact that there is a fine yellow marginal line backed with a metallic one on the lower side of the secondaries. In the female the rings around the ocelli are the same shade as the marginal line.

Biology. Undescribed.

Range. Wyoming — Yellowstone National Park. Montana — Gallatin Co., Park Co. Idaho — Fremont Co.

Haydenii Edw. is the only other species besides *tullia* in North America. It evidently exists only in the Yellowstone of Wyoming and the neighboring counties of Idaho and Montana. As will be seen, it is a large and distinct species. No comparison can be made of its early stages with those of other species, since they are not known. We can have no idea of its former distribution if it ever had any and is not an unrelated mutant form from some other American satyrid stock. Would that lepidopterists had a fossil record!

THE OEDIPPUS-GROUP

Coenonympha oedippus oedippus

Palpus—fig. 21

Venation—fig. 2

Genitalia—figs. 23, 24

Papilio oedippus Fabricius, 1787, II, p. 31.
Papilio geticus Esper, 1790, 1 (suppl.), pp. 51–52, 75–76.
Papilio iphigenus Herbst and Jablonsky, 1796, pl. CXCVIII, figs. 5, 6, 7, 8.
Papilio pylarge Hübner, (1799), pl. 52, figs. 245–246.
Papilio oedipus Ochsenheimer, 1807, I, 1, pp. 315–316.
Coenonympha oedipe Hübner, (1823), p. 65.
Satyrus oedipus, Godart, 1823, p. 544.
Maniola oedipus, Meigen, 1827, p. 155.
Hipparchia oedipus, Eversmann, 1841, pp. 38–39.
Coenonympha oedipus, Herrich-Schaeffer, 1844, 1, p. 84; Leech, 1892, pp. 94–95. (etc.).
Coenonympha oedippus, Staudinger, 1892b, p. 338; Seitz, 1908, 1, p. 143, pl. 48a; Oberthür, 1909, 3, pp. 395–399. (etc.).

Original Description. " . . alis integerrimis supra nigris immaculatis subtus fuscis: anticis ocellis subtribus, posticis quinque . . . . .

Statura omnino P. Hyperanthi. Antennae albo nigroque annulatae clara ferruginea. Alae omnes supra nigrae immaculatae, subtus fuscae ocellis subtribus, posticis, posticis quinque pupilla argentea, unico remoto. Striga marginalis argentea fere obsoleta."

Type-locality. ". . . in Russia australiori . . ."

This well-known species varies widely in every respect except the uniform color of the upper surface. The size varies between wide limits, but the males average 35 mm. and the females a millimeter or so larger.

Above the males are a uniform, dark, brownish- to blackish-grey, the female being slightly lighter. In most specimens the ocellation shows through vaguely from below, most prominently in the females.

Below, the ground color varies from grey-brown to golden- or even reddish-brown. On the primaries there may be four ocelli to none in both sexes; on the secondaries the number seems more constant, there being generally six. The ocelli vary widely in size but are generally more strongly developed in the females. There is a well-developed, yellow ochre marginal line backed by a metallic one, but these may be nearly obsolete. Some specimens have narrow, irregular, silvery-white bands just within the row of ocelli.

There seems to be no regularity in any of the above-mentioned varying characteristics.

Biology. Assmuss, 1863, pp. 396–397; Chrétien, 1886, pp. CLVII-CLVIII; Hofmann, 1893, p. 23; Habich, 1899, pp. 390–391; Gradl, 1933, p. 257.

Range. Sporadically and generally limited to the area between Lats. 42° and 55° from southwestern France eastward to eastern Asia where it merges with *magna* imperceptibly. France, Belgium, Germany, Switzerland, northern Italy, Austria, Hungary, Czechoslovakia, Poland and the Balkans. It does not occur in the British Isles and apparently not in Skandinavia. Dr. Kusnezov sends the following records for the USSR: "Kazan (Eversmann, Krulikovskij); Orenburg (Eversmann), Ufa (Krulikovskij); Volynia (Xenzopolski); Pinsk (Glazov); Smolensk (Ruhl); Taganrog (Alpheraky); Omsk (Ershov); Tomsk (Meinhardt, Vnukowskij); Baraba (Meinhardt); Altai Range (Lederer, Tshugonev, Suvortzev, Meinhardt, Vnukowskij); Barnaul (Meinhardt, Vnukowskij); Kuznetsk-Ala-tau Mts. (Tshugonov); Minussinsk (Tshugonov, Ermolaev, Kozhantishikov)." More or less typical populations occur sporadically in China, particularly to the westward (Kansu—MCZ, STB).

Coenonympha oedippus monticola

Coenonympha oedipus monticola Kolar, 1922, p. (12); Gaede in Seitz, 1930, (Supplement), 1, p. 174.

Original Description. " . . . durch die dunkelrostbraune Färbung der Unterseite, schwächere Gelbringung der Augenflecke und durchschnittlich geringere Grösse so auffalend von unseren Moosbrunner Stücken verschieden, . . . "

Type-locality. "Grigno in Sudtirol . . ."

♂♂ average 29 mm., ♀♀ slightly larger. Below there is a very narrow dull-orange marginal line and a fine metallic line. The five ocelli are ringed with dull yellow and pointed with white. The line within the ocelli, instead of being pale as in the typical, is black or darker than the ground color.

Biology. Undescribed.

Range. Apparently a very local population in the south Tyrol. Suganatal, Grigno (OB); Grigno (WIEN).

Types. OB, WIEN.

A series of *oedippus rhenana* Gradl (1933, p. 257) from Vorarlberg (WIEN—ex Kolar) I was unable to distinguish from the typical.

Unfortunately I have seen no specimens of *mariae* or *pedemontana* Rocci (1928, pp. 53–55; 1931, pp. 91–92). I can say nothing definite regarding their status but gather from the descriptions that they are two forms of the variable typical hardly worthy of names.

Coenonympha oedippus magna

Coenonympha oedippus magna Heyne in Ruhl, 1895, p. 608; Gaede in Seitz, 1930, (Supplement), 1, p. 174.

Coenonympha oedippus amurensis Heyne in Ruhl, 1895, p. 608; Seitz, 1908, 1, p. 143, pl. 48a. (etc.).

Original Description. "Eine ebenfalls grosse Form, deren Oberseite aber nicht besonders dunkel ist, denn die zahlreichen, grossen Augen der Unterseite scheinen undeutlich durch."

Type-locality. "Mongolei."

In Asia in this species there is much the same variation as in Europe. Heyne distinguishes this subspecies on the basis of its size and its strongly developed ocellation. These characteristics alone seem generally applicable to the *oedippus* of east Asia; the color of the upper surface is not regular. Some specimens from the Amur and Korea are very dark above and reddish-gold below, though in series these characters are *not* regular. Generally the ocelli, however, are very large

and close enough together to seem oval and appressed. The females, as in the typical, are slightly larger and lighter above than the males.

Biology. Undescribed.

Range. Sporadically in eastern Asia, from the Amur at least as far south as the Yangtze. "Amur" (MCZ); Chabarovka (DR); Chingan Mts. (RO); Wladimir Bay, Pogranitchnaja (RO); Nikolsk, Ussuri (WIEN); White-capped Mts., Korea (MCZ); Seishan, Korea (USNM); Seoul, Korea, (BM); Gensan, Korea (STB); Chili (WIEN); Peking (STB); Kalgan (RO, MUN); Sidemi (OB); Chefoo (BM); Tsingtau (RO); Kiaochow (WIEN); Nanjang, Honan (RO); Nanking (WIEN); Soochow (USNM); Shanghai (MUN).

Coenonympha oedippus annulifer

Coenonympha annulifer Butler, 1877, p. 91.

Coenonympha oedippus annulifer, Heyne in Ruhl, 1895, p. 608; Seitz, 1908, 1, p. 143, pl. 48a. (etc.).

Original Description. "Nearly allied to *C. geticus*, but larger, longer in the wing, much darker; on the underside with the plumbagineous streak, which bounds the ocelli of the secondaries internally, straight on its inner edge instead of undulated. Expanse of wings ♂ 1 inch 7 lines, ♀ 1 inch 10 lines."

Type-locality. "About 370 miles from Tokei (Yedo)."

Although the above description does not apply to Japanese *oedippus* in general, the name *annulifer* must stand for the island population.

This insect is not larger than the typical; the males average 34–35 mm., and the females are slightly larger. It cannot be distinguished on the basis of color from the typical. The "plumbagineous streak" is not always present, nor is it "straight on its inner edge" in all specimens.

The most marked characteristic of the Japanese insect is the rarity of ocelli on the under side of the primaries in the males; in the majority of individuals they are entirely absent. Furthermore, in the males the ocellation on the secondaries is not as strong as in *magna* or the typical. There is a single large costal ocellus separated by a space from the other four, which are in a straight line and of which the middle pair are generally the largest.

Females, however, can hardly be distinguished from those of Europe.

Biology. Undescribed.

Range. Japan. Yokohama (MCZ); Shinano (MCZ); Mt. Asama (PANS); Kobe (BM); Oiwake, Hokkaido (BM).

Type. BM.

ABERRATIONS

For those interested, I include a list of the aberrational names that have been proposed. To find the citation one may refer to the Junk Catalogue or Seitz. Other names, some of which have been used for "races", have been "sunk" in the discussion of the subspecies.

tullia
- pulla
- laidion
- lanceolata
- pallida
- posterogrisea
- unicolor

symphita
- inocellata

amyntas
- albomarginata
- belisaria
- cohaerans
- effeminata
- ocellata
- oikea
- subalpina
- theodora

arcania
- apicalis
- badensis
- dupuyi
- bipullata
- brayi
- decolorata
- defasciata
- elliptica
- euthymia
- huebneri
- leandroides
- hoefneri
- melania
- minora
- multiocellaris
- obsoleta
- exocellata
- ocellaris
- rischeri
- rufa
- schimae
- virtunensis
- addenda
- wagneri
- suprophthalmica
- punctata
- bavarica
- caeca
- carnica
- dubia
- impunctata
- obscura
- unicolor
- caecaella
- biocellata

arcanioides
- biocellata
- pluriocellata
- inocellata
- obliterata
- nigroocellata

hero
- areteoides
- heromorpha
- herota
- marmorata
- euryleuca

dorus
- triocellata
- caeca
- exoculata
- biojos
- fulvia
- infrasimplex

vaucheri
- geminipuncta
- mediocellis

corinna
- anophthalmica
- caeca
- energica
- gynandra
- nigricans
- saturata
- macrophthalmica

pamphilus
- addenda
- alba
- amaryllides
- biocellata
- bipunctata
- bipupillata
- caeca
- caecaella
- havelaari
- lineigera
- multipuncta
- neca
- nolckeniana
- obsoleta
- ocellata
- nosalica
- pallescens
- eburnea
- albula
- unicolor
- corinnaeformis
- nigromarginata
- albescens

oedippus
- miris

albina
deplumbea
gelini
hungarica
leucotaenia
lucasi
ocellata
ocellaris
ornatissima
unicata
crasselineata
anulisdiffusa
crassepupillata
lanceolata
spoliata
nobilis
attingens
irregularis
oiwakensis
lambertei
obscurior
maculata

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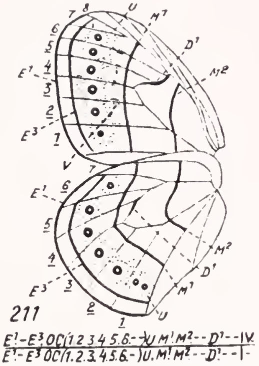
EXPLANATION OF PLATES

PLATE 1

Plate **1**

Fig. 1. Archetype color-pattern of *Coenonympha* (after Schwanwitsch, 1935).
Fig. 2. Venation of *oedippus*.
Fig. 3. Detail of venation in *arcania arcania*.
Fig. 4. Same.
Fig. 5. Same.
Fig. 6. Venation of *haydenii*.
Fig. 7. Detail of venation of *semenovi*.



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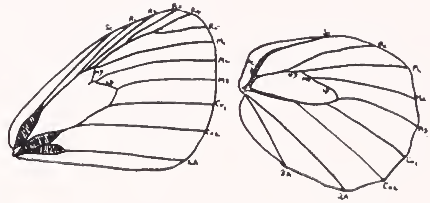

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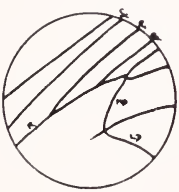

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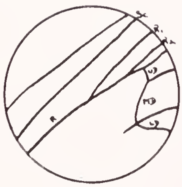

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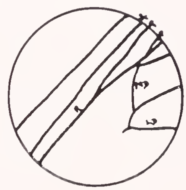

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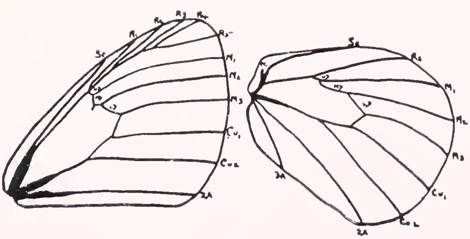

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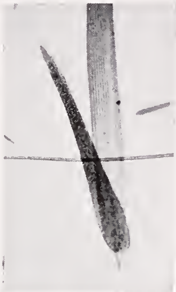
PLATE 2

Plate **2**

Androconial Scales (approx. 240 x)

Fig. 8. *amyntas amyntas* from the vicinity of Wien.
Fig. 9. same.
Fig. 10. *amyntas pearsoni* from Orihuela del Tremedal.
Fig. 11. *amyntas iphioides* from Cuenca.
Fig. 12. same—"eomorphic type".
Fig. 13. *amaryllis amaryllis* from Semipalatinsk.
Fig. 14. *amaryllis tydeus* from Szechwan.
Fig. 15. *symphita symphita* from Transcaucasia.
Fig. 16. *pamphilus pamphilus* from the Altai.



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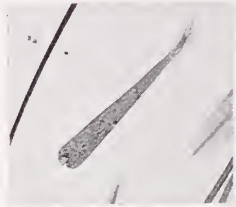

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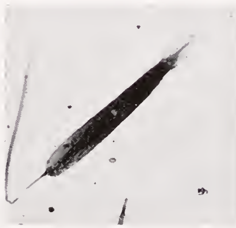

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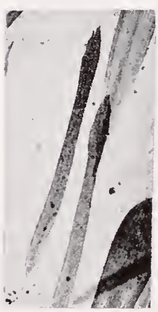

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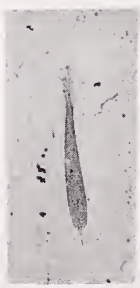

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PLATE 3

Plate **3**

Fig. 17. Androconial scale of *pamphilus lyllus* from Huelamo. (approx. 240x)

Fig. 18. Androconial scale of *thyrsis* from Assitaes. (approx. 240x)

Fig. 19. Androconial scale of *dorus dorus* from Huelamo. (approx. 165x)

Fig. 20. Androconial scale of *dorus nicholasi* from Aïn Draham, Tunis. (approx. 165x)

Fig. 21. Palpus of *oedippus*.

Fig. 22. Palpus of *haydenii*.

Fig. 23. ♂ genitalia of *oedippus* in lateral view.

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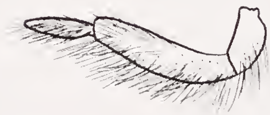

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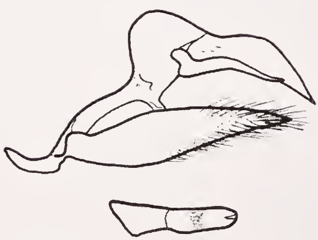

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PLATE 4

Plate 4

Fig. 24. ♂ genitalia of *oedippus* in ventral view.
Fig. 25. ♂ genitalia of *haydenii* in lateral view.
Fig. 26. ♂ genitalia of *semenovi* in lateral view.
Fig. 27. ♂ genitalia of *tullia benjamini* in lateral view.
Fig. 28. same in ventral view.
Fig. 29. valve end of *arcania gardetta* from Zermatt.

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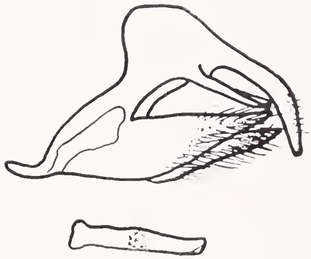

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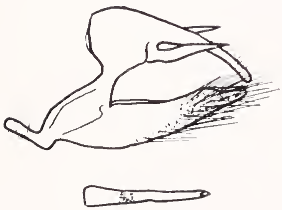

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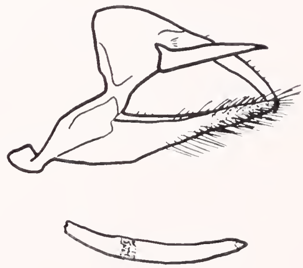

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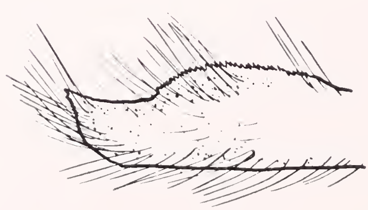

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PLATE 5

Plate 5

Fig. 30. The Distribution of *Coenonympha tullia* in North America

- kodiak
- mixturata
- ampelos
- eryngii
- california
- columbiana
- benjamini
- ochracea
- mackenziei
- furcae
- subfusca
- inornata
- mcisaaci
- nipisiquit

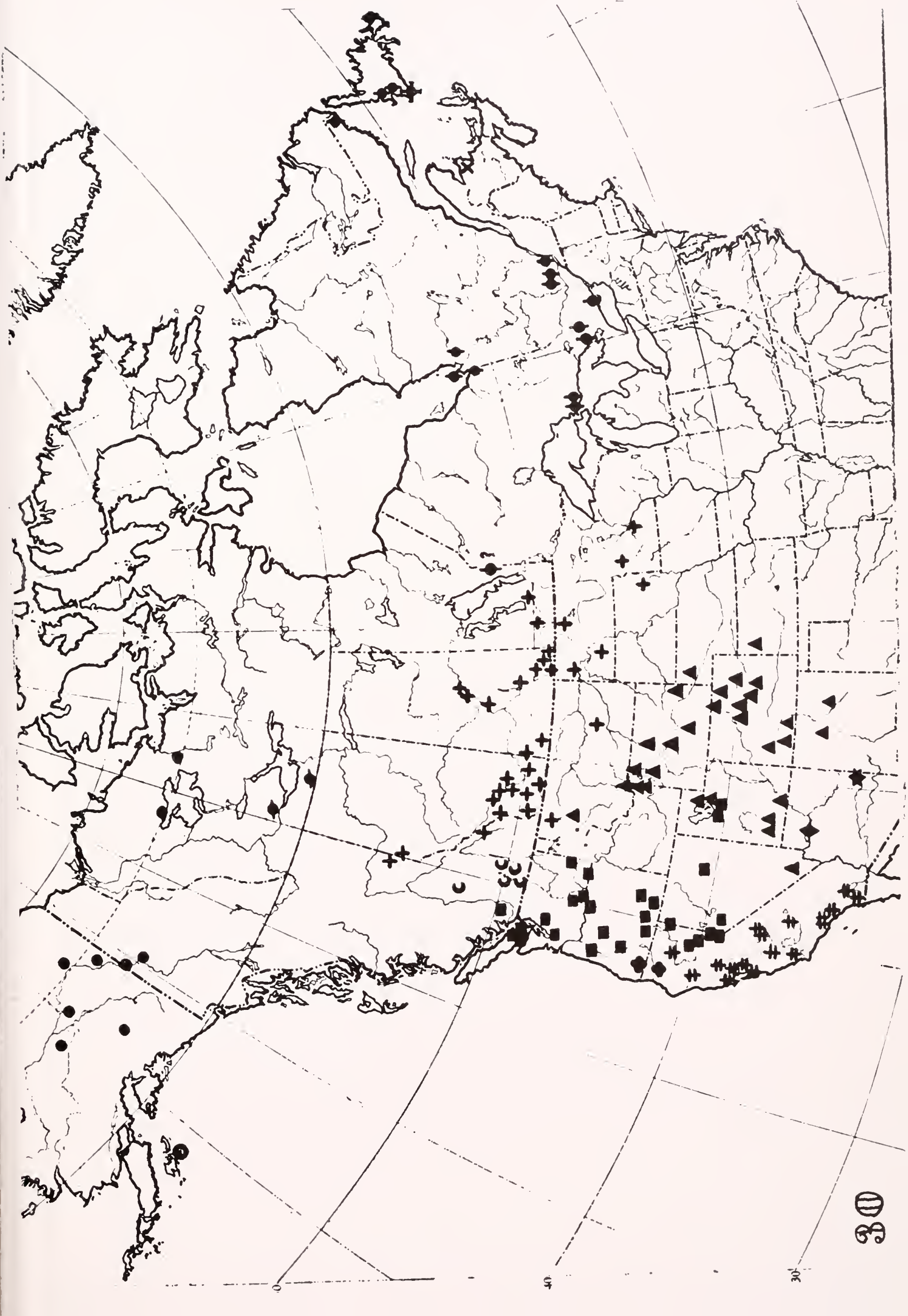

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PLATE 6

Plate 6

Fig. 31. The Distribution of the Genus in Eurasia.

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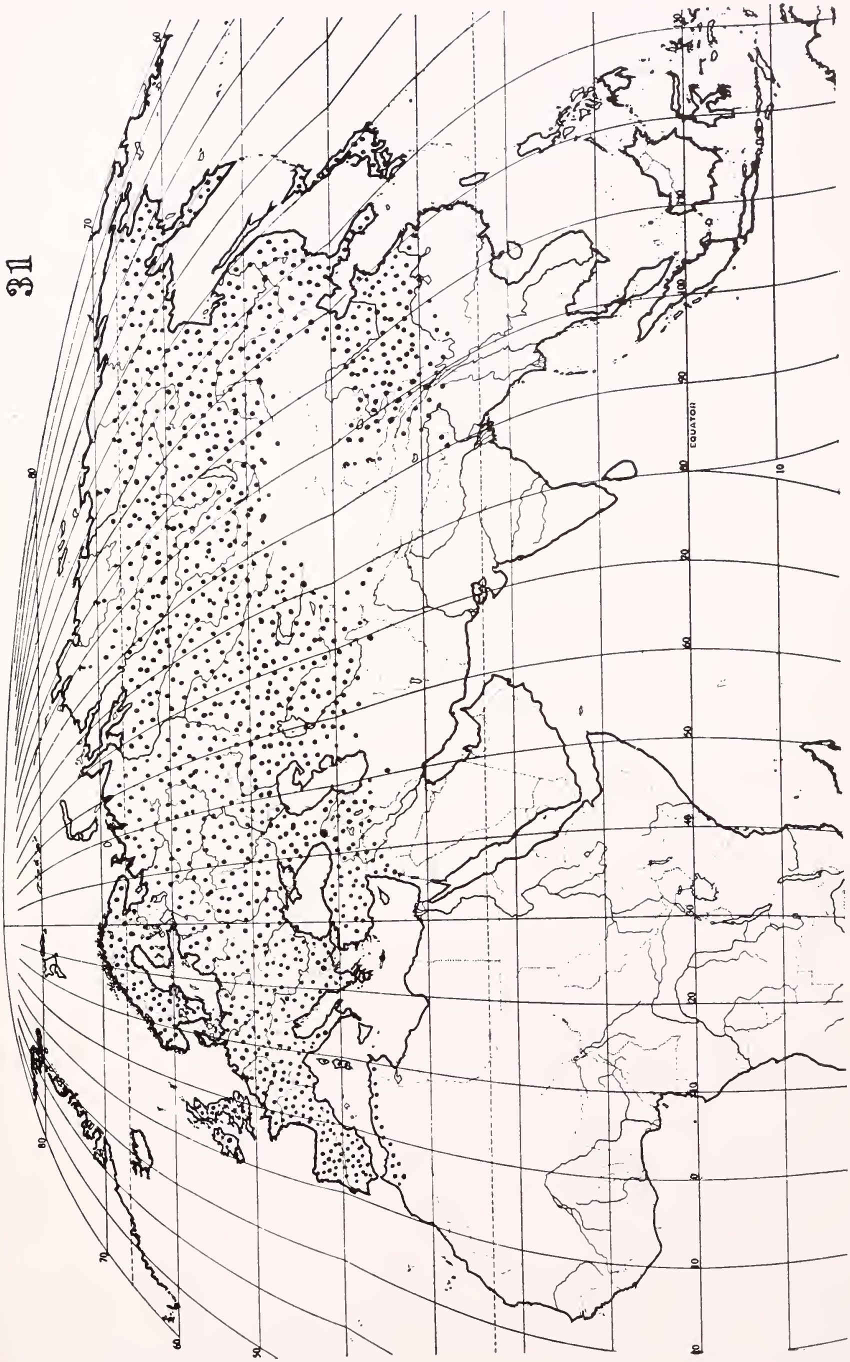

PLATE 7

Plate **7**

Fig. 32. Larva of *tullia inornata* in the 4th instar. (alcohol—approx. 11x)
Fig. 33. Chrysalis of *tullia inornata.* (approx. 10x)

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PLATE 8

Plate 8

American *tullia* subspecies

Fig. 34

benjamini ♂, Waterton Lakes, Alta.
benjamini ♀, North Dakota.
benjamini ♂, underside, North Dakota.
columbiana ♂, Penticton, B.C.
columbiana ♀, Penticton, B.C.
columbiana ♂, underside, "British Columbia".

Fig. 35

mcisaaci ♂, Doyles Sta., Nfd.
mcisaaci ♀, Doyles Sta., Nfd.
mcisaaci ♂, underside, Doyles Sta., Nfd.
inornata ♂, Nominingue, P.Q.
inornata ♀, Nominingue, P.Q.
inornata ♂, underside, Nominingue, P.Q.

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PLATE 9

Plate **9**

American *tullia* subspecies (contin.)

Fig. 36

ampelos ♂, Victoria, B.C.
ampelos ♂, underside, Vancouver I., B.C.
ampelos ♂, underside, Oregon.
ampelos ♂, underside, Oregon, summer form.
ampelos ♂, underside, Utah.
ampelos ♂, underside, Plumas Co., Calif.

Fig. 37

subfusca ♀, White Mts., Ariz.
subfusca ♂, underside, White Mts., Ariz.
furcae ♀, Grand Canyon, Ariz.
furcae ♂, underside, Grand Canyon, *Ariz.*
california ♂, California, spring form.
california ♂, underside, California, spring form.

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PLATE 10

Plate **10**

Fig. 38

American *tullia* subspecies (contin.)

ochracea ♂, Colorado.
ochracea ♂, underside, Colorado.
mackenziei ♂, underside, Fort Providence, Mack. Dist.
ochracea ♂, underside, Yellowstone Pk., Wyo.
ochracea ♂, underside, Utah
mackenziei, ♂, underside, Nyarling River, Mack. Dist.

Fig. 39

Coenonympha haydenii ♂, Yellowstone Pk., Wyo.
Coenonympha haydenii ♀, Yellowstone Pk., Wyo.
Coenonympha haydenii ♂, underside, Yellowstone Pk., Wyo.

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Vol. LXXXVII. No. 5

MCZ-L

REVISION OF THE AFRICAN LIZARDS OF THE FAMILY AMPHISBAENIDAE

By Arthur Loveridge

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No. 5 — *Revision of the African Lizards of the Family Amphisbaenidae*

By Arthur Loveridge

With the single exception of an uncritical key to the species published by Werner (1910b, pp. 37–42), no attempt has been made to evaluate the fifty African species of this family which have been described during the fifty-five years that have elapsed since the treatment of the family in Boulenger's (1885e, p. 430) monumental "Catalogue of Lizards in the British Museum". In this work will be found an extensive review of the principal characteristics of the family which it has not been deemed necessary to republish here.

For the purposes of the present revision I have made full use of the material in the Museum of Comparative Zoölogy, Cambridge, Massachusetts, and take this opportunity of thanking Professor O. Arcangeli (Università di Torino), Dr. E. R. Dunn (Academy of Natural Sciences, Philadelphia), V. FitzSimons (Transvaal Museum), Mr. P. de Grys (Hamburg Museum), Mr. H. W. Parker (British Museum Natural History), and Dr. G. de Witte (Royal Museum Brussels) for their kindness in answering questions regarding types in their charge, as well as for lending specimens of doubtful status.

Quite naturally curators have hesitated to lend types which would, if lost in the post, be impossible to replace. Unfortunately these amphisbaenids, on account of their mode of life, are, with the exception of a few species, still very rare in collections. This will be seen from the fact that more than thirty of those species recognized here are still known only from the type or type series. A compensating factor, however, is that almost all the species described during the past half-century have been adequately figured.

My method of approach, therefore, has been to study the largest available series of a single species from one locality. From the resultant data it has been possible to deduce with a reasonable degree of accuracy the probable range of variation within a species of that particular genus. It becomes evident that these creatures are subject to a greater degree of variability than hitherto has been supposed. Their progressive specialization has led to reduction in head shields by fusion, yet even in so important a character as the presence of only one or two shields covering the head we find it breaking down in the case of *Monopeltis guentheri* and *capensis,* of which individuals with either one or two shields occur in the same locality.

While doubtless many species remain to be discovered and described, it is equally probable that several of those now recognized will

eventually find their way into the synonymy when more abundant material is available for study. It seems almost certain, for example, that *Monopeltis anchietae* will have to be united with *M. c. capensis.* I have endeavoured to maintain a conservative attitude, however, and have given particular attention to the geographical probabilities before synonymizing any species. Even so, for reasons stated in their appropriate place, I have found the undermentioned genera and species untenable.

Chirindia Boulenger, 1907	=*Amphisbaena* Linné, 1758.
Amphisbaenula Sternfeld, 1911	=*Amphisbaena* Linné, 1758.
Trogonophis wiegmanni maroccana Werner	=*T. wiegmanni* Kaup.
Agamodon a. immaculatus Calabresi	=*A. compressus* Mocquard.
Amphisbaena petersii Boulenger	=*A. leucura* Duméril & Bibron.
Amphisbaena ambuellensis Monard	=?*A. q. quadrifrons* Peters.
Geocalamus noltei Boettger	=*G. acutus* Sternfeld.
Monopeltis leonhardi Werner	=*M. anchietae* (Bocage).
Monopeltis quadriscutata Werner	=*M. anchietae* (Bocage).
Monopeltis okavangensis Monard	=*M. anchietae* (Bocage).
Monopeltis devisi Monard	=*M. anchietae* (Bocage).
Lepidosternon magnipartitum Strauch	=*M. galeata* (Hallowell).
Monopeltis unirostralis Mocquard	=*M. galeata* (Hallowell).
Monopeltis boveei Mocquard	=*M. galeata* (Hallowell).
Monopeltis boulengeri Boettger	=*M. guentheri* Boulenger.
Monopeltis truncata Witte	=*Dalophia gigantea* (Peracca).
Monopeltis granti Boulenger	=*Dalophia pistillum* (Boettger).
Monopeltis colobura Boulenger	=*D. pistillum* (Boettger).
Monopeltis g. transvaalensis FitzSimons	=*D. pistillum* (Boettger).
Monopeltis mossambica Cott	=*D. pistillum* (Boettger).
Monopeltis granti kuanyamarum Monard	=*D. pistillum* (Boettger).

Taxonomic changes. Other changes involved include the revival of *Dalophia* for those members of a natural group within *Monopeltis* possessing truncated tails.

The application of the name *capensis* Thominot to the eastern race of *Amphisbaena quadrifrons* Peters, now recognized for the first time.

The description of a new species of *Amphisbaena* (of the *Chirindia* group) from southeastern Tanganyika Territory, and a new *Placogaster* from Sierra Leone.

The following remarks may help to clarify the procedure adopted.

Citations. In the case of family or genera, citations are restricted to the original appearance of a newly proposed name and its African

synonyms. In the case of species the reference is given in full for new names only, while, with a view to curtailing printing, an abbreviated form of reference is given to titles which will be found in full in the Bibliography at the end of this paper. Though nearly 1,500 papers on African herpetology have been searched for references to amphisbaenids, mention was found only in 208. Doubtless some must have been overlooked, but these cannot be numerous and are likely to be confined chiefly to the North African genera *Trogonophis* and *Blanus*. The Senegal records contained in Rochebrune's, 1884, "Faune de la Sénégambie." have been omitted intentionally: not only on account of no one else having found amphisbaenids in Senegal, but because of the improbability of many of the species cited occurring within a thousand miles of Senegal!

Descriptions. These are not transcribed from Boulenger or *verbatim* from the original descriptions. They have been entirely rewritten on a uniform basis and embody all the reliable variations recorded by subsequent writers. This point is important, for owing to the fusion of head shields, more particularly in the genus *Amphisbaena*, nomenclatorial confusions have resulted, so that the homologous shield in two closely related species has been differently designated by different authors. Even Boulenger himself erred occasionally, for example the frontal is usually an azygous shield lying between and slightly in advance of the oculars and followed by a pair of postfrontals. In those species where the frontal has disappeared through fusion, however, he calls the postfrontals "a pair of frontals", while the shields hitherto regarded as parietals become "postfrontals". Again in describing *Chirindia*, being based on the most extreme example of reduction in shields, it was very natural that some confusion in terminology should arise, for it is only since the subsequent discovery of *ewerbecki*, *orientalis* and *bushbyi* that it has been possible to trace the successive stages of what has occurred. We find that the temporals first approach, (*orientalis*), then meet in a point (*bushbyi*), and finally form a broad suture (*swynnertoni*) on the median line between the postfrontals and the parietals!

Dentition. Remarks by recent authors appear to indicate that the dentition of a given species may be subject to some variation so that it is not quite so diagnostic of a species as was originally supposed. Ultimately it may be found desirable to give the range of teeth under the generic, rather than the specific diagnoses. Owing to the difficulty of examining the teeth without damaging the type, few recent authors have given the dental formula for their new species. In this revision,

therefore, I have quoted the formulae given by Boulenger, only augmenting or altering them when additions or corrections have appeared in the literature, except in the case of the new species (*rondoensis*) here described and that of its nearest ally.

Measurements. The total length of the largest recorded specimen is given. This is followed by the length of head and body plus that of tail of the same individual.

Sexual dimorphism. In the genus Agamodon, dimorphism has been alleged to take the form of absence of preanal pores in the females, this certainly appears to be the case with the *Chirindia* group of *Amphisbaena.* The point might be checked in the genus *Monopeltis* where the presence or absence of pores is common to so many species.

Breeding. Except in the case of *Trogonophis wiegmanni, Dalophia pistillum,* and the present note on *Amphisbaena ewerbecki,* nothing appears to have been recorded!

Diet. The few statements made are, for the most part, vague.

Parasites. I have failed to locate mention of any except for *Trogonophis.*

Enemies. Known only for *Amphisbaena swynnertoni, Geocalamus modestus,* and *Dalophia pistillum.*

Distribution. Under this heading the political areas have been arranged on a definite geographical plan, the place names, however, are arranged alphabetically within the political area in which they occur.

Illustrations. I am indebted to the skill of Mr. E. N. Fischer for drawings of the six East African species which have not been figured satisfactorily before, and to Mr. George Nelson for the excellent photographs of original figures. These have been enlarged, or reduced, to a uniform size—the smallest commensurate with clearness—so that they are not to scale, nor is it possible to state the scale in many cases as it was not stated in the original.

Index to the Species recognized

* An asterisk signifies that there are examples in the Museum of Comparative Zoölogy.

Family AMPHISBAENIDAE

1825. Amphisbaenidae Gray, Ann. Philos. (2), **10**, p. 203.
1844. Trogonophidae Gray, Cat. Tort. Brit. Mus., p. 68.

For further family and generic citations see Boulenger (1885e, p. 430) from whom the following definition is adapted.

Habit vermiform in adaptation to a subterranean existence; head covered with symmetrical plates or shields; eyes concealed beneath the skin; mouth small, frequently inferior; teeth large, few, anchylosed to the upper (Emphyodontes) or inner (Prosphyodontes) edge of the jaws, premaxillary teeth usually in odd number, pterygoid teeth absent; tongue moderate, elongate, arrow-headed, covered with imbricate scale-like papillae, terminating in two long, narrow, smooth points; ear absent; skin divided into soft squarish segments forming regular annuli; tail usually short.

Skull thick, strongly ossified, no interorbital septum; no columella cranii; no postorbital and no frontosquamosal arches; no epipterygoids; premaxillary single; nasals paired; frontals paired; parietal single, very large; quadratum very oblique or nearly horizontal, owing to the shortness of the post-coronoid part of the mandible; occipital condyle frequently divided. Vertebrae numerous, depressed, all except the foremost without spinose processes; pectoral and pelvic arches rudimentary. No osteoderms.

Range. South America northwards to Florida (see remarks); Africa and the Mediterranean region.

Remarks. As originally proposed by Gray (1825, p. 203) the Amphisbaenidae were regarded as limbless. If the American *Bipes* (syn. *Chirotes*), which he (1844, p. 74) relegated to a separate family (*Chirotidae*), be included, then the range is to southern Lower California and the definition of the family requires some alteration. Boulenger (1885e, p. 430) combined both limbed and limbless forms in Amphisbaenidae.

Camp (1923, p. 316) places the family in a superfamily Amphisbaenoidea of the section Scincomorpha, division Autarchoglossa of the suborder Sauria. Here they follow the Teiidae, as in Boulenger, but terminate the section instead of preceding the Lacertidae.

Synopsis of the Genera

I. Segments of the pectoral region not differentiated.
  A. More than 40 segments in a midbody annulus.
    1. Rostral not enormous, nor strongly compressed with arched cutting edge.
      a. No azygous frontal; no preanal pores . . . . *Trogonophis* (p. 359)
      b. An azygous frontal.
        A pair of large prefrontals . . . . *Pachycalamus* (p. 364)
        No prefrontals . . . . *Agamodon* (p. 365)
    2. Rostral enormous, strongly compressed with arched cutting edge . . . . *Baikia* (part) (p. 368)
  B. Less than 40 segments in a midbody annulus.
    1. Rostal enormous, strongly compressed with arched cutting edge . . . . *Baikia* (part) (p. 368)
    2. Rostral not enormous, nor strongly compressed with arched cutting edge.
      a. Less than 150 annular rings from head to anus . . . . *Blanus* (p. 371)
      b. More than 150 annular rings from head to anus.
        Median ventral segments not more than three times as broad as long . . . . *Amphisbaena* (p. 373)
        Median ventral segment six times as broad as long . . *Placogaster* (p. 399)

II. Segments of the pectoral region more or less enlarged, or forming an angular series.
  A. Snout strongly compressed; tail bluntly rounded . . . . *Geocalamus* (p. 401)
  B. Snout depressed.
    1. Tail bluntly rounded; preanal pores present or absent . . . . *Monopeltis* (p. 405)
    2. Tail abruptly truncate, ending in a callous pad; preanal pores absent . . . . *Dalophia* (p. 428)

Genus Trogonophis

1830. *Trogonophis* Kaup, Isis von Oken, **23**, col. 880 (type *wiegmanni*).

Head slightly compressed, snout rounded; nostril lateral, pierced in a large nasal; no gular fold; a vertebral line, a stronger lateral line,

no ventral line; pectoral segments not enlarged; no praenal pores; tail conical, pointed. Teeth anchylosed to the parapet of the jaws. *Range.* Northwest Africa.

Trogonophis wiegmanni Kaup

1830. *Trogonophis Wiegmanni* Kaup, Isis von Oken, **23**, col. 880, pl. viii, fig. i: No locality.
1831. Férussac, p. 203.
1839. Duméril & Bibron, p. 469.
1844. Gray, p. 68.
1848. Gervais, p. 205.
1850. Guichenot, p. 16.
1851. Eichwald, p. 438.
1853. Gervais, p. 308.
1862b. Strauch, p. 47.
1865. Gray, p. 445.
1867. Lallemant, p. 26.
1867a. Steindachner, p. 55.
1872. Gray, p. 33.
1873. Gray, p. 114.
1878. Müller, p. 622.
1881f. Boettger, p. 146.
1881. Strauch, pp. 373, 476.
1883a. Boettger, p. 108.
1885b. Boettger, p. 466.
1885e. Boulenger, p. 470.
1887a. Boulenger, p. 508.
1889b. Boulenger, p. 303.
1889. Fischer, p. 49.
1891c. Boulenger, pp. 96, 122.
1892. Anderson, p. 12.
1893a. Boettger, p. 78.
1894. Olivier, p. 117.
1896b. Olivier, p. 122.
1898. Jeude, p. 24.
1900. Doumergue, p. 346, pl. xix, fig. 5a.
1901b. Doumergue, p. 244, pl. xix, fig. 5a (reprint of 1900).
1903. Mayet, p. 21.
1905g. Boulenger, p. 73.
1905. Rosén, p. 138.
1906. Barbier, p. 64.
1907. Le Cerf, p. 23.
1908. Zulueta, p. 454.
1909a. Zulueta, p. 354.
1912a. Pellegrin, p. 256.

1912b. Pellegrin, p. 263.
1916e. Chabanaud, p. 461.
1917. Maluquer, p. 430.
1920c. Chabanaud, p. 461.
1925b. Flower, p. 949.
1926a. Pellegrin, p. 316.
1926f. Pellegrin, p. 160.
1927a. Pellegrin, p. 262.
1929b. Werner, pp. 9, 23.
1935. Hediger, p. 11, fig. 2.
1835. *Amphisbaena elegans* Gervais, ? 1836, Bull. Soc. Sci. Nat. France, p. 113: Algeria; Tangier; and Zafarin Islands.
1836. Gervais, p. 311.
1837. Gervais, p. 3, cl. iii, pl. xi.
1841. *Amphisbaena Wiegmannii* Schlegel, p. 122, pl. vi.
1931c. *Trogonophis Wiegmanni maroccana* Werner, Sitz. Akad. Wiss. Wien, **140**, **1**, p. 280: Chella, near Rabat, French Morocco.
1935. Laurent, p. 347.

Native names. Bou Sih'at (Arabic, Oran); *tepha* (in error, see under Folklore).

Fig. 1. *Trogonophis wiegmanni* (Type of *elegans* after Gervais).

Description. Rostral large, pentagonal, its posterior angle inserted between the nasals; nasal entire, forming a suture with its fellow behind the rostral; a pair of large prefrontals; no frontal; a pair of postfrontals; a pair of small parietals; a pair of occipitals, large, or scarcely differentiated from the adjacent segments of the first annulus, or absent; loreal usually separated from, sometimes in contact with, the ocular; ocular moderate, surrounded by 5–8 plates (some of which may be termed supra-, pre-, infra-, sub- and postoculars) sometimes including loreal and prefrontal; no well-defined temporals; 4–5 upper labials, third largest; mental large, subpentagonal; 3–5 lower labials, second usually largest; postmental triangular, its apex in contact with that of a triangular chin shield, or separated from the latter by a

suture of the anterior pair of large sublabials; 2 pairs of sublabials; 135–156 annuli on body, 12–15 on tail; 48–64 (22–32 + 25–34) segments in a midbody annulus, the median ventral rows undifferentiated; 6–10 anals; 0 preanal pores.

Dentition. Premaxillary teeth 5; maxillaries 4–4; mandibulars 8–8.

Coloration. Very variable. Above and below greyish white chequered with purplish brown; or dorsum glossy brown chequered with darker brown, and belly yellow or white, chequered with brown; or uniform fuliginous grey, a little lighter below.

Measurements. Total length 259 (240 + 19) mm.

Sexual dimorphism. According to Doumergue, the tail of the male is slightly flattened below and exhibits a faint longitudinal depression, that of the female is rounded.

Breeding. At 9 a.m. on June 10, Doumergue (1901, p. 246) found two adults intertwined and moving over each other, though not actually copulating, on the surface of the sand into which they burrowed, reappearing later. In September, Hediger (1935, p. 11) confined a specimen from Rabat in a collecting bag in which it gave birth to five young, one of these was still attached to a large yolk-mass and coiled in a membranous sac some thirty millimetres in length, others were fully formed, the largest 69 mm. in length.

Longevity. One was a year in captivity in Vienna. Fischer states that they are hardy in captivity but uninteresting as they remain out of sight so much, though poking their heads out of the ground at night. He suggests that they should be shipped in damp moss or earth in tins, and emphasizes the necessity of keeping the soil in their vivarium damp.

Diet. According to Fischer they feed well on mealworms (*Alphitobius diaperinus*) and larvae of *Gnathocerus cornutus* in captivity. In a wild state they live upon small beetles, ants, slugs, earthworms and such other creatures as are to be found beneath the stones where they dwell.

Parasites. Mites and ticks; while proglottides of a tapeworm have been found in the excrement according to Fischer.

Defence. If disturbed when wandering on the surface, *Trogonophis* rolls itself into a stiff spiral, only uncoiling when attempting to burrow; if uncovered by removal of a stone its instinct is to seek shelter by burrowing.

Temperament. Of a gentle disposition, occasionally extruding its tongue, if picked up this amphisbaenid will twine about the fingers of the hand which holds it.

Habitat. Though recorded from Mogador as late as December 6, these amphisbaenids hibernate during December and January, emerging in February; they are plentiful in May, June and July. They prefer damp ground rich in humus in which they make deep winding burrows. During cool weather they may be found lying beneath stones on the surface. When the sun is powerful, and the surface soil begins to lose its humidity, they burrow to a depth of at least six inches. They emerge during rainstorms while extensive flooding drives many to the surface. Fischer thinks that they are crepuscular or nocturnal.

Distribution. **Tangiers:** Tanger. **Spanish Morocco:** Larache; Mellila; Tetuan; Tifazor; Zafarin Island. **French Morocco:** Agadir; Azimour; Berguent; Casablanca; Chella; Dar Anflous; Djebel Taghat; Dradek; El Aioun; Fedala; Fenzou; Fez; Fort Gurgens; Guercif; Imi n'Tanout; Koreina; La California; La Chiffa; Maidnet; Mogador; Oued Akrench; Oued n'Fis; Rabat; Sale; Sidi Abd el Djellil; Sidi Ali; Sisi Slimani; Tamaruth Valley; Taourirt; Uezzan. **Algeria:** Ain el Hadjar; Ain Temouchent; Alger; Arzeu; Batna; Batterie espagnole; Biskra; Blidah; Bone; Budshia; Cap Matifu; Djebel Mourdjadjo; Hamman Meskoutine; Hussein Dey; La Calle; Laghouat; Maison Carree; Mecheria; Oran; Polygone; Rachgoun Island; Sebdou; Sidi Douma; Tiemcen. **Tunisia:** Tamesmida.

Folklore. Many Arabs believe *Trogonophis* to be the young of the horned viper (*Cerastes cornutus*), calling it 'tepha', the common name for the viper. They fear the violet-brown phase as being the most poisonous, attributing blindness, distended stomachs and other maladies to its bite, despite the fact that the small gape would prevent its biting effectually. One colonial engineer found many Arabs refusing to cultivate land that was infested with *Trogonophis.* Both Arabs and settlers are apt to kill it on sight (Fischer, 1889).

Remarks. The color form *maroccana,* of which the Museum of Comparative Zoölogy possesses the type and paratypes, was described on the assumption that *wiegmanni* was based on an Algerian variety, a somewhat doubtful point. Under any circumstances the name *elegans* would take precedence over *maroccana* for Gervais figures the form described by Werner, while one of his types came from Tangier, relatively not far distant from Werner's type locality, Chella. There appears, however, to be no geographical significance in the occurrence of the forms for Werner, himself, took both near Oran. See also Hediger's (1937, p. 188) remarks on an Uezzan specimen.

Genus Pachycalamus

1881. *Pachycalamus* Günther, Proc. Zool. Soc. London, p. 461 (type *brevis*).

Head strongly depressed, snout rounded; nostril inferior, between two small nasals; no gular fold; no vertebral line, no lateral line, a ventral line; pectoral segments not enlarged; praenal pores; tail slightly depressed, obtusely pointed. Teeth anchylosed to the parapet of the jaws.

Range. Socotra Island, Indian Ocean.

Pachycalamus brevis Günther

1881. *Pachycalamus brevis* Günther, Proc. Zool. Soc. London, p. 462, figs.: Socotra Island.
1882b. Peters, p. 46.
1883. Taschenberg, p. 168.
1885e. Boulenger, p. 471.
1885b. Müller, p. 171.
1903a. Boulenger, p. 84.
1903. Steindachner, p. 12.
1910b. Werner, p. 42.

Description. Rostral large, trapezoid, its posterior border broadest, straight; nasal divided, between rostral, first and second labial, pre-

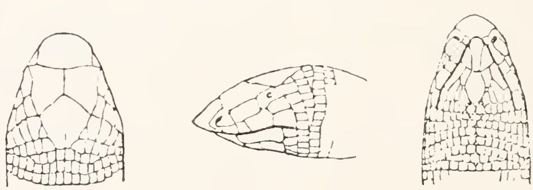

Fig. 2. *Pachycalamus brevis* (Type after Günther).

ocular and prefrontal; a pair of large prefrontals; a large frontal, angular anteriorly; no postfrontals, parietals or well-differentiated occipitals; no supraocular; preocular elongate; ocular moderate, in contact with preocular, prefrontal, frontal (narrowly), two temporals, subocular, and anteriorly with fourth labial; eye distinct; 5 upper labials, first very small, fourth and fifth largest; mental elongate; 3 lower labials, first small, second largest; postmental separating two anterior chin shields which are followed by a posterior row of 6 chin

shields; 165–173 annuli on body, 19–20 on tail; 48–50 segments in a midbody annulus, uninterrupted except by ventral groove, the median ventral rows undifferentiated; 6–8 anals; 4 preanal pores.

Dentition. Premaxillary teeth 3; maxillaries 3–3; mandibulars 6–6.

Coloration. Above, brown, except head which is yellowish white; below, uniform yellowish white.

Measurements. Total length 213 (198 + 15) mm.

Habitat. Found beneath stones, from sea level to an altitude of about 2,000 feet. Easily captured.

Distribution. **Socotra Island:** Hadibu Plain: Dahamis and Homhil; Haggier Mountain; Jena-agahan; Tamarida. (Known from the six cotypes in the British Museum, besides numerous other specimens).

Genus Agamodon

1882b. *Agamodon* Peters, Mitth. Sitz. Akad. Wiss. Berlin, p. 322 (type *anguliceps*).

Head strongly depressed, snout projecting, truncate; nostril lateral in a moderate nasal; no gular fold; a vertebral line, no lateral line, a ventral line; median dorsal and ventral segments roundish, scale-like; pectoral segments not differentiated; preanal pores present or absent; tail compressed, pointed. Teeth anchylosed to the parapet of the jaws.

Range. Italian Somaliland and Arabia.

Synopsis of the Species

123–137 annuli on body, 15–19 on tail; 0, 2, 4 or 6 preanal pores . . . . *anguliceps* (p. 365)

143–160 annuli on body, 18–23 on tail; 0 or 2 preanal pores . . . . *compressus* (p. 367)

161 annuli on body, 18 on tail; 0 preanal pores (only known from type) . *arabicus* (Arabia)

Agamodon anguliceps Peters

1882c. *Agamodon anguliceps* Peters, Mitth. Sitz. Akad. Wiss. Berlin, p. 322, pl. ix: Brava, Italian Somaliland.
1888. Mocquard, p. 120.
1890d. Boulenger, p. 79.
1893b. Boettger, p. 132.
1897g. Boulenger, p. 278.
1897i. Boulenger, p. 17.
1898a. Boulenger, p. 717.

1898c. Boulenger, p. 916.
1909c. Boulenger, p. 308.
1910b. Werner, p. 42.
1913. Lönnberg & Andersson, p. 2.
1915. Calabresi, p. 239.
1927. Calabresi, pp. 27, 44.
1929c. Scortecci, p. 255.
1931b. Scortecci, p. 144.

Description. Rostral large, trapezoid, its posterior border largest, straight, forming a long suture with the large quadrangular frontal which covers the whole upper surface of the head; nasal moderate,

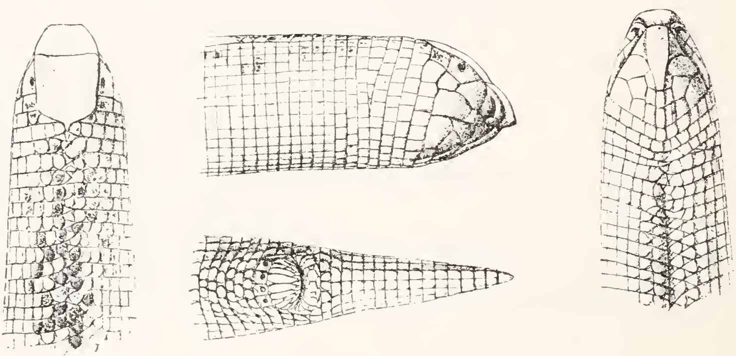

Fig. 3. *Agamodon anguliceps* (Type after Peters).

between rostral, loreal, and three labials; no prefrontals, postfrontals, parietals or occipitals; no supraoculars; ocular moderate, eye distinct; subocular small; four superimposed scales which might be termed temporals; 3–4 upper labials, first very small (said to be fused with the nasal in the type), fourth very large; mental narrow, elongate; 3–4 lower labials, third largest; chin shields small, irregular; no sublabials; 127–137 annuli on body, 15–19 on tail; about 40 segments in a midbody annulus but dorsal and ventral rows strongly differentiated from the lateral segments; 7–10 anals; 2–6 preanal pores, usually 4 in males, absent in females.

Dentition. Premaxillary teeth 3; maxillaries 2–2; mandibulars 5–5.

Skeleton. The skull has been figured and described by Peters (1882c, p. 324, pl. ix).

Coloration. Above yellowish white, back with irregular black or

dark maroon spots which may coalesce to form an interrupted longitudinal line; below immaculate.

Measurements. Total length 186 (170 + 16) mm.

Distribution. **Italian Somaliland:** Alessandra; Brava; Chisimayu Jumbo; Mahaddei; Mofi; Mogadish.

Agamodon compressus Mocquard

1888. *Agamodon compressum* Mocquard, Mem. Soc. Philom. Cent., p. 121, pl. xi, figs. 2–2c: Somaliland.
1893b. Boettger, p. 132.
1897g. Boulenger, p. 278.
1897i. Boulenger, p. 17.
1910b. Werner, p. 42.
1915. Calabresi, p. 240.
1927. Calabresi, p. 44.
1927. *Agamodon anguliceps immaculatus* Calabresi, Atti, Soc. Ital. Sci. Nat. Milano, **66**, pp. 27, 44: Afghedud, Italian Somaliland.

Description. Agrees with *anguliceps* in most respects, apparently differing in its more strongly compressed body, the greater develop-

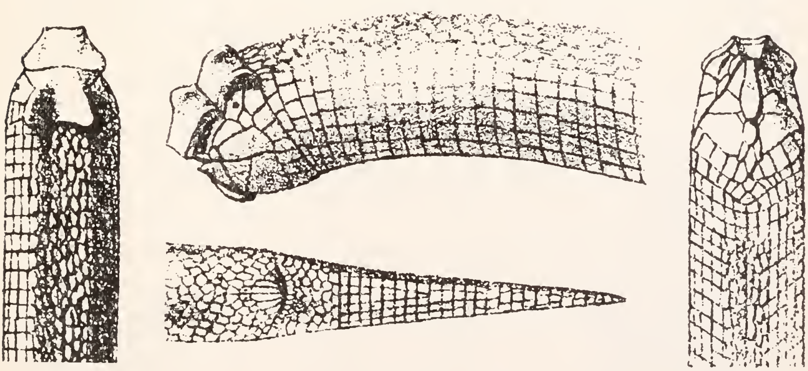

Fig. 4. *Agamodon compressus* (Type after Mocquard).

ment of the cephalic shields whose lateral edges are upturned to form outward and obliquely backward-directed crests; 3–4 upper labials; 3–4 lower labials; 143–160 annuli on body, 18–23 on tail; vertebral line strongly grooved; 8 anals; 2 preanal pores in males, absent in females.

Coloration. Above uniform yellow ochre, or ashy grey becoming yellowish white posteriorly on body and tail, unspotted; below immaculate.

Measurements. Total length 111 (99 + 12) mm. for type of *immaculatus;* 103 (90.5 + 12.5) mm. for type of *compressus.*

Sexual dimorphism. Preanal pores are believed to be present in the males only.

Distribution. **Italian Somaliland:** Afghedud; Brava; Mogadish.

Remarks. Mocquard had seven males and two females of *anguliceps* in the same collection from which he described the holotype of *compressus.* If pores are only present in males, then the type of *compressus,* which had two, was a male. Calabresi states that her type of *immaculatus* was a male with two pores, her Mogadish example of *compressus* a female with none. No mention being made of pores, it seems probable that the Brava specimen mentioned by Boulenger was also a female. The fact that both species occur together at Brava and Mogadish, eliminates the possibility of subspecific treatment. *Agamodon arabicus* Anderson (1901, p. 140), of which the British Museum has received no second example up to the time of writing (1937), is very closely related to *compressus.*

Genus Baikia

1865. *Baikia* Gray, Proc. Zool. Soc. London, p. 450 (type *africana*).

Head strongly compressed, snout vertically wedge-shaped, arched; nostril lateral, pierced in a large rostral with a cutting edge; a circular fold separating head from body; no vertebral line, a lateral line, no ventral line; pectoral segments not enlarged; preanal pores; tail cylindrical, obtuse. Teeth supposedly anchylosed to the sides of the jaws.

Range. Africa north of the equator.

Remarks. *Anops* Bell, 1833 (type species *kingii* Duméril & Bibron), to which Boulenger (1885e, p. 452) referred *africana,* is preoccupied for reptiles by *Anops* Oken, 1815, proposed for crustacea. Thus *Baikia* becomes the correct name for the genus of African amphisbaenids even though the South American *kingii* is considered congeneric. Stejneger (1916, p. 85), however, believing that they will prove generically distinct, has proposed *Anopsibaena* for the latter. *Baikiea,* proposed by Gray in 1870 for certain soft-shelled turtles, does not affect the issue.

Synopsis of the Species

38 segments in a midbody annulus; 248 annuli on body, 25 on tail (West Africa) *africana* (p. 369)

49–52 segments in a midbody annulus; 197–199 annuli on body, 6–7 on tail (East Africa) . . . . *somalica* (p. 370)

BAIKIA AFRICANA Gray

1865. *Baikia africana* Gray, Proc. Zool. Soc. London, p. 451, figs. 3–4: West Africa.
1872. Gray, p. 39, figs. 20–21.
1873. Gray, p. 117.
1916. Stejneger, p. 85.
1881. *Amphisbaena africana* Strauch, p. 421.
1885e. *Anops africanus* Boulenger, p. 452, pl. xxiii, figs. 4a–4d.
1887a. Boulenger, p. 508.
1898. Werner, p. 207.
1902c. Tornier, p. 674.
1910b. Werner, p. 41.
1919. *Anopsibaena africanus* Schmidt, p. 599.

Description. Rostral enormous, compressed, arched, with sharp cutting edge; nasal fused with rostral anteriorly; no frontal; two pairs

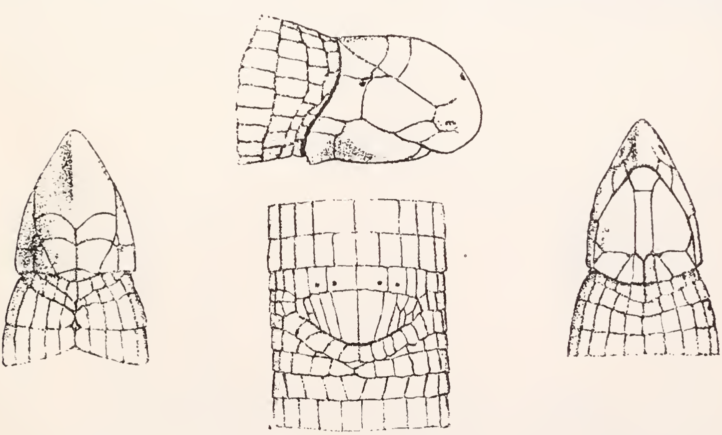

Fig. 5. *Baikia africana* Gray (Type after Boulenger).

of shields behind rostral, *i.e.* a pair of postfrontals and a pair of parietals; postfrontal transversely elongate, below in contact with the

second labial and ocular; no preocular; ocular very small, triangular, in contact with postfrontal, parietal, temporal, second and third labials; eye distinguishable, under the supero-anterior edge of the third labial; 3 upper labials, first small, second largest; mental quadrangular; 2 lower labials, anterior very large, posterior small; postmental elongate; 4 chin shields flanked by a sublabial; 248 annuli on body, 25 on tail; 38 (20 + 18) segments in a midbody annulus, the 2 median ventral segments slightly broader than long, dorsal segments longer than broad; 10 anals; 4 preanal pores.

Coloration. Uniformly flesh coloured.

Measurements. Total length 202 (180 + 22) mm.

Distribution. **West Africa.** (Known only from the type, collected by Dr. Balfour Baikie, in the British Museum).

Remarks. Boulenger (1887a, p. 508) has amended the miscount of body annuli which appeared in the Catalogue of Lizards of 1885.

Baikia somalica (Scortecci)

1930c. *Anops somalicus* Scortecci, Boll. Mus. Zool. Torino, **41**, No. 10, p. 6, figs. 1–5: Caitoi, Uebi Scebeli, Italian Somaliland.

Description. Rostral enormous, compressed, arched, with sharp cutting edge; no nasal but its position indicated by a suture, nostril

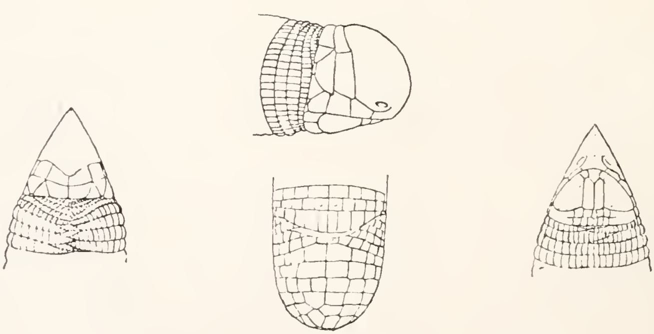

Fig. 6. *Baikia somalica* (Type after Scortecci).

in the rostral; no prefrontal; no frontal; two pairs of shields behind rostral, *i.e.* a pair of postfrontals and a pair of parietals; postfrontal below in contact with preocular and ocular; preocular large, elongate, resting on the first and second labials; ocular large, subtriangular, in

contact with preocular, postfrontal, parietal (even though barely), two temporals, second and third (or second only) labials; eye distinct or hidden; 2 temporals, separated by posterior angle of ocular; 3 upper labials, first small, second largest; mental pentagonal; 3 lower labials, first very small, second very large; a pair of elongate postmentals; 5 chin shields followed by a second row of 6, flanked by a large sublabial in contact with the second and third lower labials; 197–199 annuli on body, 6–7 on tail; 49–52 (27–28 + 22–24) segments in a midbody annulus, the 2 median ventral segments considerably broader than long; dorsal segments longer than broad; 10 anals; 1–2 preanal pores.

Coloration. Above and below, uniformly light rosy grey.

Measurements. Total length 167 (160 + 7) mm.

Distribution. **Italian Somaliland:** Caitoi on the Webi Shebeli (Known only from the type in the Turin Museum, and paratype in the Milan Museum).

Genus Blanus

1830. *Blanus* Wagler, Natur. Syst. Amphibien, p. 197 (type *cinereus*).

Head moderate or slightly depressed, snout rounded; nostril lateral, pierced in the first upper labial; a circular fold separating head from body; a vertebral line, a distinct lateral line, no ventral line; pectoral segments not enlarged; preanal pores; tail cylindrical, pointed. Teeth anchylosed to the sides of the jaws.

Range. Borders of the Mediterranean.

Blanus cinereus (Vandelli)

1797. *Amphisbaena Cinerea* Vandelli, Mem. Acad. Sci. Lisboa, **1**, p. 69: Portugal (restricted).
1836. Gervais, p. 311.
1837. Gervais, p. 2, cl. iii, pl. x.
1841. Schlegel, p. 139.
1848. Gervais, p. 205.
1881. Strauch, p. 416.
1883a. Boettger, p. 109.
1884. Bedriaga, p. 24, figs. 1–3, pl. iv.
1824. *Amphisbaena oxyura* Wagler in Spix, Serp. Brasiliensium, p. 72, pl. xxv, fig. 1: Rio de Janeiro, Brazil (error).
1835. Gervais, p. 112.
1829. *Amphisbaena rufa* Hemprich, Verh. Ges. Naturf. Freunde Berlin, p. 130: Locality unknown.

1830. *Blanus cinereus* Wagler, p. 197.
1844. Gray (part), p. 72.
1853. Gervais, p. 297, pl. xiv, figs. 5–7.
1867a. Steindachner, p. 53.
1872. Gray (part), p. 34.
1873. Gray (part), p. 114.
1875. Schreiber, p. 334, figs.
1885e. Boulenger, p. 433.
1891c. Boulenger, pp. 96, 121.
1893a. Boettger, p. 76.
1894. Olivier, p. 117.
1897. Bateman, p. 148.
1900. Doumergue, p. 344, pl. xix, figs. 5–5a.
1901b. Doumergue, p. 242 (reprint of 1900 paper).
1901. Gadow, p. 566.
1912. Schrieber, p. 520, fig. 105.
1916e. Chabanaud, p. 231.
1926a. Pellegrin, 1925, p. 316.
1926e. Pellegrin, p. 121.
1927a. Pellegrin, p. 262.
1928. Mertens & Müller, p. 27.
1929b. Werner, pp. 13, 22.
1931c. Werner, p. 279.
1935. Hediger, p. 11.
1936. *Blanus rufus* Wiegmann, p. 157.

(The foregoing bibliography is incomplete with regard to European records).

Description. Rostral moderate, trapezoid, forming a suture with the frontal; no nasal, nostril pierced in the first labial; no prefrontals; a large frontal, about as broad as long; a pair of squarish postfrontals; a pair of squarish parietals; a pair of squarish occipitals; these three rows of paired scales, forming part of annular rings on the head, are subject to azygous subdivisions; no supraocular; no preocular; ocular moderate, eye distinguishable; postocular segment-like; temporals segment-like; 4 upper labials, first largest, fourth smallest; mental trapezoid; 3–4 lower labials, first and fourth smallest; postmental large, in contact with mental and followed by an anterior row of 3–4 chin shields, these by a posterior one of 5–7 shields; head separated from body by a distinct fold; 110–128 annuli on body, 20–42 on tail; 30–34 (12–16 + 16–18) segments in a midbody annulus, the median ventral rows undifferentiated; 4–6 anals, median pair usually enlarged; 3–3, 4–4, or 4–5 preanal pores.

Dentition. Premaxillary teeth 7; maxillaries 4–4; mandibulars 7–7.

Skeleton. The skull has been figured by Gervais (1854, pl. xiv).

Coloration. Above greyish, each segment more or less brown; below as above but with many segments unpigmented.

Measurements. Total length 245 (220 + 25) mm.

Habitat. In Portugal they occur in manure heaps. Gadow found that they soon became dry and contracted on removal from their environment, becoming turgid and supple when returned to moist soil.

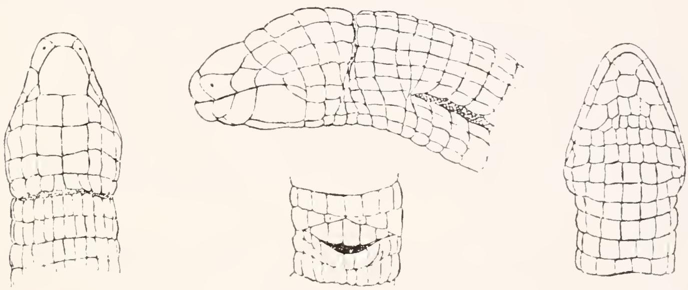

Fig. 7. *Blanus cinereus* (after Schreiber).

Distribution. **Spain. Portugal. Tangiers:** Tanger. **Spanish Morocco:** Tetuan. **French Morocco:** Ain el Hardjar; Azrou; Djebel Zalagh near Fez; Djebel Zerhoun near Mulay Idris; Boulhaut; Mogador to Marrakesch; Mogador; Oued Ykem; Rabat. **Algeria:** Batna; Tebessa.

Genus Amphisbaena

1758. *Amphisbaena* Linné, Syst. Nat. (ed. 10), **1**, p. 229 (type *fuliginosa*).
1844. *Sarea* Gray, Cat. Tortoises Brit. Mus., p. 71 (type *caeca*).
1844. *Cynisca* Gray, Cat. Tort. Brit. Mus., p. 71 (type *leucura*).
1861. *Diphalus* Cope, Proc. Acad. Nat. Sci. Philadelphia, p. 75 (type *fenestratus*).
1865. *Bronia* Gray, Proc. Zool. Soc. London, p. 448 (type *brasiliana*).
1878. *Ophioproctes* Boulenger, Bull. Soc. Zool. France, **3**, p. 300 (type *liberiensis*).
1885. *Aporarchus* Cope, Proc. American Philos. Soc., **22**, p. 187 (type *prunicolor*).
1907g. *Chirindia* Boulenger, Ann. Mag. Nat. Hist. (7), **20**, p. 48 (type *swynnertoni*).
1911a. *Amphisbaenula* Sternfeld, Sitz. Ges. Naturf. Freunde Berlin, p. 246 (type *orientalis*).

Head moderate, snout rounded or feebly compressed; nostril lateral, pierced in a nasal which may have fused with other shields; no gular fold; a vertebral line, a lateral line, no ventral line; pectoral segments not enlarged; ventral segments at most not more than three times as broad as long; preanal pores present or absent; tail cylindrical, obtuse. Teeth anchylosed to the sides of the jaws.

Coloration. The coloration of the African species of this genus being substantially the same, *viz.* flesh-pink or pinky mauve in life, or brownish above, paler below in alcohol, it has not been considered necessary to repeat it for each species.

Range. Tropical Africa; Tropical America.

Remarks. According to Cope, *Aporarchus* was supposedly distinguishable only by the absence of preanal pores. Boulenger (1885e, p. 443) found them present, though scarcely discernible, in all his material, as is the case with the dozen examples in the Museum of Comparative Zoölogy.

Chirindia was separated only by the absence of pores (a sexual character in that section) and ocular. This stage of evolution has been reached independently in both west and east and apparently does not represent a natural grouping. Thus we find *schaeferi* of the Cameroon without pores obviously more closely related to *haughi* of the French Congo with pores than to the poreless species in the southeast. Both species, being known only from the types, may represent opposite sexes.

Amphisbaenula was stated by its author to differ from *Chirindia* only by the presence of pores, yet when describing the type species *orientalis,* Sternfield states that pores are sometimes absent in his series!

Amphisbaena, as here understood, furnishes a very delightful sequence of forms undergoing adaptation to a burrowing existence. This specialization takes the form of reduction in head shields by fusion, reduction in the number of segments in a midbody annulus, and reduction, or loss, of pores.

Synopsis of the Species

I. An azygous median frontal and an ocular present.

A. Nasals and prefrontals distinct . . . . *kraussi* (p. 376)

B. Nasals and prefrontals fused.

First and second upper labials distinct . . . . *leucura* (p. 377)

First upper labial fused with nasal, second distinct . . . . *mülleri* (p. 379)

First and second upper labials fused with nasal and preocular.

A pair of parietals; a postmental; 24 segments in a midbody annulus; 3–7 preanal pores . . . . *leonina* (p. 379)

Parietals fused with postfrontals; 18 segments in a midbody annulus; 9–11 preanal pores . . . . *oligopholis* (p. 380)

II. No azygous median frontal.

A. Preanal pores 8–10 (except *schaeferi* which has none).

1. Ocular distinct.

No parietals but a pair of occipitals; a postmental; 22–24 segments in a midbody annulus . . . . *liberiensis* (p. 381)

A pair of parietals and occipitals; no post-mental; 16 segments in a midbody annulus . . . . *bifrontalis* (p. 383)

2. Ocular fused with nasal.

16 segments in a midbody annulus; 8 preanal pores . . . . *haughi* (p. 384)

22 segments in a midbody annulus; 0 preanal pores . . . . *schaeferi* (p. 384)

B. Preanal pores 6 or less, or lacking (see also *schaeferi* above). Africa south of the equator.

1. Ocular distinct.

a. A preocular between prefrontal and labials.

221–242 annuli on body only; range South West Africa eastwards to the Kalahari . . . . *q. quadrifrons* (p. 385)

198–221 annuli on body only; range from the Kalahari eastwards to Mozambique . . . . *q. capensis* (p. 387)

b. No preocular (being fused with prefrontal).

Prefrontal and first upper labial distinct.

An ocular, eye distinct; 46–59 annuli on tail; 4 preanal pores. *violacea* (p. 389)

No ocular, eye hidden; 20 annuli on tail; 6 preanal pores. . . . . *phylofiniens* (p. 390)

Prefrontal and first upper labial fused with nasal; eye hidden; 5–6 preanal pores . . . . *mpwapwaensis* (p. 391)

2. Ocular, preocular, prefrontal frontal and first labial all fused with nasal (second labial also fused except in *langi*, where it covers the eye).
   a. First lower labials separated by postmental.
      Temporals broadly in contact on the median line separating postfrontals from parietals.
         12 (very rarely 10) dorsal and 12 ventral segments in a midbody annulus; 266–280 annuli on body, 28–29 on tail. . . . *ewerbecki* (p. 392)
         10 (invariably) dorsal and 10 ventral segments in a midbody annulus; 227–247 annuli on body, 23–28 on tail. . . . . *rondoensis* (p. 394)
      Temporals separated by postfrontals and parietals; 12 dorsal and 10 ventral segments in a midbody annulus; 257–260 annuli on body, 24–26 on tail . . . .*orientalis* (p. 396)
   b. First lower labials in contact behind mental.
      Temporals in contact on the median line separating postfrontals from parietals; 12 dorsal and 12 ventral segments in a midbody annulus.
         Temporals barely in contact in a point between postfrontals and parietals; 235 annuli on body, 27 on tail. . . . . . *bushbyi* (p. 397)
         Temporals broadly in contact between postfrontals and parietals; 246 annuli on body, 24 on tail. . . . . .*swynnertoni* (p. 397)
      Temporals well separated by postfrontals and parietals; 286–290 annuli on body, 30–32 on tail. . . . .*langi* (p. 399)

AMPHISBAENA KRAUSSI Peters

1878b. *Amphisbaena Kraussi* Peters, Sitz. Ges. Naturf. Freunde Berlin, p. 192: West Africa.
1878c. Peters, p. 781, pl. –, fig. 5.
1881. Strauch, p. 388.
1885e. Boulenger, p. 447.
1910b. Werner, p. 40.
1919. Schmidt, p. 601.

Description. Rostral moderate, triangular; nasals half as long as prefrontals, forming a suture behind the rostral; frontal very small; a pair of postfrontals; a pair of parietals; a pair of occipitals; no supraocular; a preocular separating nasal from ocular, eye distinct; 3 upper

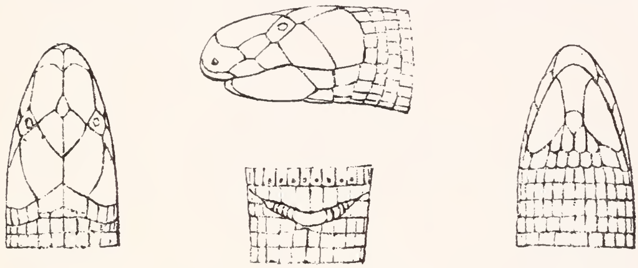

Fig. 8. *Amphisbaena kraussi* (Type after Peters).

labials, third largest; a very large temporal; mental elongate; 2 lower labials, first very large, second small; postmental small; 4 chin shields, all in contact with first lower labials; 6 anals; 8 preanal pores.

Distribution. **West Africa.** (Known only from the description of the types in the Berlin Museum).

Amphisbaena leucura Duméril & Bibron

1839. *Amphisbaena leucura* Duméril & Bibron, Erpét. Gén., **5**, p. 498: Guinea Coast.
1862. Peters, p. 25.
1879b. Peters, p. 277, pl. –, fig. 5.
1881. Strauch, p. 388.
1885e. Boulenger, p. 447.
1901c. Tornier, p. 73.
1910b. Werner, p. 40.
1917c. Chabanaud, p. 87.
1919. Schmidt, p. 601.
1844. *Cynisca leucura* Gray, p. 71.
1865. Gray, p. 448.
1872. Gray, p. 36.
1906i. *Amphisbaena petersii* Boulenger, Ann. Mus. Civ. Stor. Nat. Genova (3), **2**, p. 201: Gold Coast and Jebba, Upper Niger, Nigeria.
1910b. Werner, p. 40.
1913c. Werner, p. 14.

Description. Rostral moderate, triangular; nasal fused (at least anteriorly) with prefrontal, forming a long suture with its fellow

behind the rostral; no prefrontals; frontal large, between the supraoculars; a pair of postfrontals; a pair of parietals; one or two pairs of occipitals; a supraocular; a preocular separating only lower part of nasal from ocular; eye distinct; a postocular; 3 upper labials, third largest; 3–4 moderate temporals; mental elongate; 2 lower labials, first very large, second small; postmental present (*petersii*), or absent

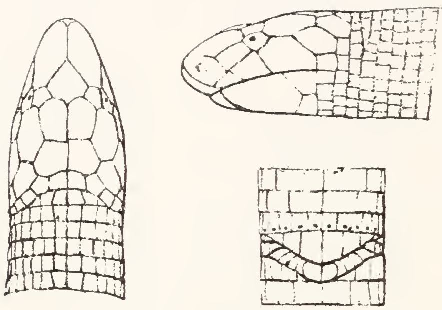

Fig. 9. *Amphisbaena leucura* (after Peters).

(*leucura*); 4 chin shields, all in contact with first lower labials; 206–233 annuli on body, 28–29 on tail; 24–34 (12–20 + 12–14) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 6–10 anals; 8–10 preanal pores.

Dentition. Premaxillary teeth 5; maxillaries 4–4; mandibulars 7–7.

Measurements. Total length 258 (226 + 32) mm.

Distribution. **Nigeria:** Calabar; Jebba; Keana. **Dahomey:** Agouagou. **Togoland:** Kete Kratje; Klein Popo; Mangu; Sokode. **Gold Coast:** Accra; Keta. **Liberia** (Hamburg Museum, examined).

Remarks. Tornier (1901c, p. 73) points out misprints and errors in Boulenger's (1885e, p. 447) key to this species. When proposing the name *petersii* for the specimen figured by Peters (1879, fig. 5), Boulenger states that *leucura* has no postmental, while *petersii* has. Duméril & Bibron make no mention of this point in their description of *leucura*, presumably the type was later examined by Boulenger. In view of the instability observed in postmentals and chin shields both as regards division and fusion in members of this genus — some of which have been figured for *liberiensis* by Brongersma — I am not prepared to recognise *petersii* as a valid species on the basis of this single character, more particularly as it does not appear to be correlated with geographical distribution.

Amphisbaena mülleri Strauch

1878. *Cynisca* sp. Müller, Verh. Naturf. Ges. Basel, **6**, p. 704, pl. ii, fig. c: Akropong, Goldcoast.
1881. *Amphisbaena Mülleri* Strauch, Mél. Biol. Acad. Sci. St. Pétersbourg, **11**, p. 389: Akropong, Goldcoast.
1885e. Boulenger, p. 448.
1893c. Matschie, p. 210.
1910b. Werner, p. 40.
1919. Schmidt, p. 601.

Description. Rostral moderate, triangular; nasal fused with first labial, preocular and prefrontal, forming a long suture with its fellow behind the rostral; no prefrontals; frontal small; a pair of postfrontals;

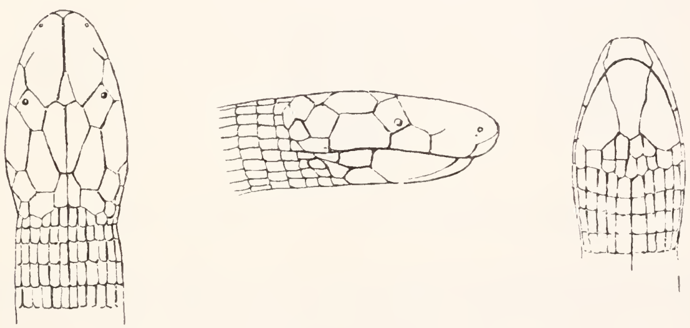

Fig. 10. *Amphisbaena mülleri* (Type after Müller).

a pair of parietals; no occipitals; no supraocular; no preocular; ocular large, eye distinct; 2 (second and third) upper labials, posterior largest; 3 moderate temporals; mental elongate; 2 lower labials, first very large, second small; no postmental; 4 chin shields, all in contact with first lower labials; 229–240 annuli on body, 25–27 on tail; 24–26 (12 + 12–14) segments in a midbody annulus; 6 anals; 12 preanal pores.

Measurements. Total length 195 (175 + 20) mm.

Distribution. **Gold Coast:** Akropong. **Sierra Leone.** (Known only from the cotypes in the Basel and Stuttgart Museums).

Amphisbaena leonina Müller

1885d. *Amphisbaena leonina* Müller, Ver. Naturf. Ges. Basel, **7**, p. 700, pl. ix, figs. a–e: Tumbo Island, French Guinea.
1885e. Boulenger, p. 448.
1910b. Werner, p. 41.
1939a. Parker, p. 89.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular and prefrontal, forming a long suture with its fellow behind the rostral; no prefrontals; frontal small; a pair of postfrontals; a pair of parietals; no occipitals; no supraocular; no preocular; ocular large, eye distinct; 1 (third) upper labial; 2 temporals, upper very large, forming an extensive suture with a postfrontal and parietal; mental elongate; 2 lower labials, first very large, second small;

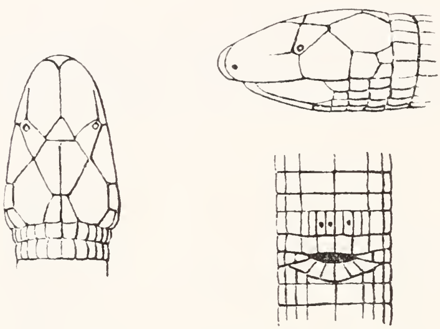

Fig. 11. *Amphisbaena leonina* (Type after Müller).

a postmental, flanked on either side by a chin shield which is in contact with a first lower labial; 227–240 annuli on body, 20–21 on tail; 24 (14 + 10) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 6 anals; 3–7 preanal pores.

Measurements. Total length 170 (155 + 15) mm.

Distribution. **Portuguese Guinea:** Rio Pongo. **French Guinea:** Kassa and Tumbo in the Los Islands. (Known only from the type in Basel Museum, a second specimen in the Royal Brussels Museum, and a third in Hamburg Museum, which latter I have examined).

Remarks. Closely related to *Placogaster degrysi* sp. n., of Lagos, Sierra Leone, for points of difference see page 000 Parker (1939a) comments on the conspicuousness of the middorsal furrow which he says is as noticeable as those on the flanks.

Amphisbaena oligopholis Boulenger

1906i. *Amphisbaena oligopholis* Boulenger, Ann. Mus. Civ. Stor. Nat. Genova (3), **2**, p. 201, fig. 1: Cassine River district, Portuguese Guinea.
1910b. Werner, p. 40.
1919. Schmidt, p. 601.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular and prefrontal, forming a long suture with its fellow behind the rostral; no prefrontals; frontal small; a pair of very elongated postfrontals; no parietals (obviously fused with postfrontals); no occipitals; no supraocular; no preocular; ocular moderate, eye hidden; 1 (third) upper labial; 1 large temporal with which are fused the scales normally below it; mental elongate; 2 lower

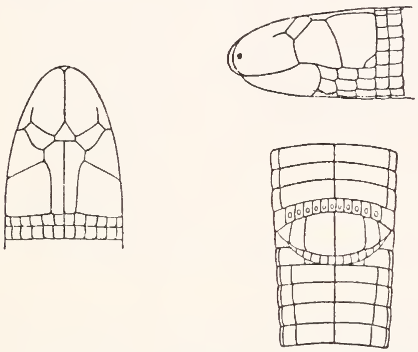

Fig. 12. *Amphisbaena oligopholis* (Type after Boulenger).

labials, first very large, second small; no postmental; 4 chin shields, all in contact with first lower labials; 219–248 annuli on body, 12–28 on tail; 18 (10 + 8) segments in a midbody annulus, the 2 median ventral segments 3 times as broad as long; 4–6 anals; 9–11 preanal pores.

Measurements. Total length 165 (147 + 18) mm.

Distribution. **Portuguese Guinea:** Cassine River district. (Known only from the eight cotypes in the Genoa and British Museums).

Amphisbaena liberiensis (Boulenger)

1878. *Ophioproctes Liberiensis* Boulenger, Bull. Soc. zool. France, **3**, p. 301, figs. 1–3: Liberia.
1881. *Amphisbaena liberiensis* Strauch, pp. 369, 390.
1885e. Boulenger, p. 449.
1890. Büttikofer, pp. 443, 478.
1906. Johnston, pp. 816, 833.
1910b. Werner, p. 40.
1919. Schmidt, p. 599.
1930a. Barbour & Loveridge, p. 784.
1935. Brongersma, p. 259, figs. 1–6.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal;

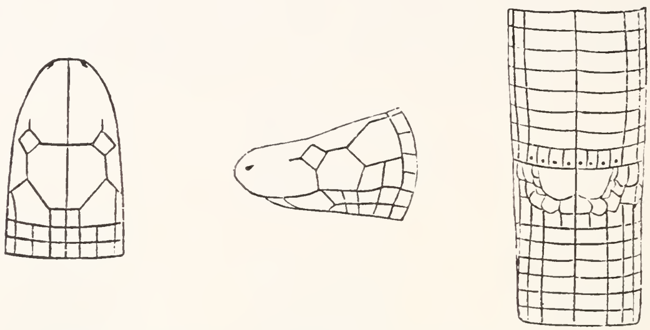

Fig. 13. *Amphisbaena liberiensis* (Type after Boulenger).

a pair of postfrontals; no parietals (obviously fused with postfrontals); a pair of occipitals; no supraocular; no preocular; ocular moderate, eye hidden; 1 (third) upper labial, sometimes giving off a smaller one

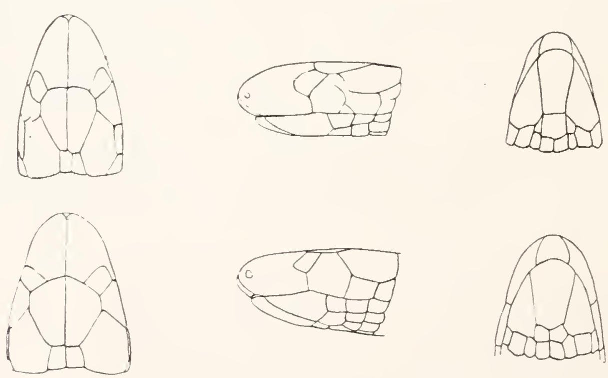

Fig. 14. *Amphisbaena liberiensis* (Variants after Brongersma).

by division; 3 large temporals, subject to subdivision; mental elongate; 2 lower labials, first very large, second small; postmental, flanked on either side by a chin shield, or alternatively 2–4 chin shields only and no postmental; 219–236 annuli on body, 24–27 on tail; 22–24 seg-

ments in a midbody annulus, the 2 median ventral segments from two and a half to three times as broad as long; 2 anals; 8 preanal pores.

Measurements. Total length 153 (135 + 18) mm.

Habitat. One was taken in a hollow tree by Büttikofer.

Distribution. **Liberia:** Robertsport; Soforeh Place, fifty miles up the St. Paul's River. (Known only from the type in the Brussels Museum and three examples in Leiden Museum).

AMPHISBAENA BIFRONTALIS Boulenger

1906i. *Amphisbaena bifrontalis* Boulenger, Ann. Mus. Civ. Stor. Nat. Genova (3), **2**, p. 202, fig. 2: Fernand Vaz, French Congo.
1910b. Werner, p. 41.
1919. Schmidt, p. 599.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, prefrontal and frontal, forming a long

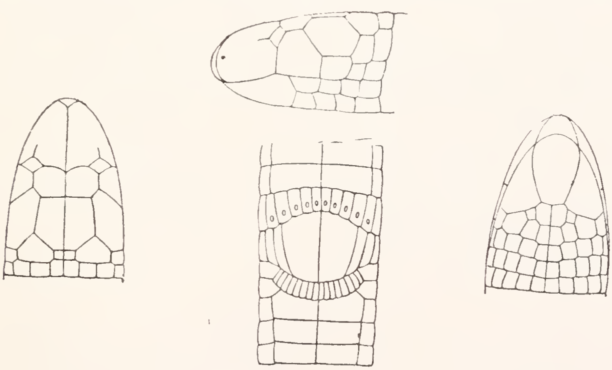

Fig. 15. *Amphisbaena bifrontalis* (Type after Boulenger).

suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals, as broad as long; a pair of parietals; a pair of occipitals; no supraocular; no preocular; ocular moderate, eye hidden; 1 (third) upper labial; 3 large temporals; mental elongate; 2 lower labials, first very large, second small; no postmental; 4 chin shields, all in contact with first lower labials; 237 annuli on body, 13 (? mutilated) on tail; 16 (8 + 8) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 6 anals; 10 preanal pores.

Measurements. Total length 140 (130 + 10) mm.

Distribution. **French Congo:** Fernand Vaz. (Known only from the type in the Genoa Museum).

Amphisbaena haughi Mocquard

1904. *Amphisbaena Haughi* Mocquard, Bull. Mus. Paris, **10**, p. 301: Southwest of Lambarene, French Congo.
1910b. Werner, p. 41.
1919. Schmidt, p. 599.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals; a pair of parietals; no supraocular; no preocular; no ocular, eye hidden; 1 (third) upper labial; 2 large temporals (lower called a labial by Mocquard); mental elongate; 2 lower labials, first very large, second small; 235 annuli on body, 29 on tail; 16 (8 + 8) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 2 anals; 8 preanal pores.

Measurements. Total length 140 (124 + 16) mm.

Distribution. **French Congo:** about fifty kilometres southwest of Lambarene. (Known only from the type in the Paris Museum).

Amphisbaena schaeferi (Sternfeld)

1912a. *Chirindia schaeferi* Sternfeld, Sitz. Ges. Naturf. Freunde Berlin, p. 250, fig. 2: Japoma, Cameroon.
1919. Schmidt, p. 599.

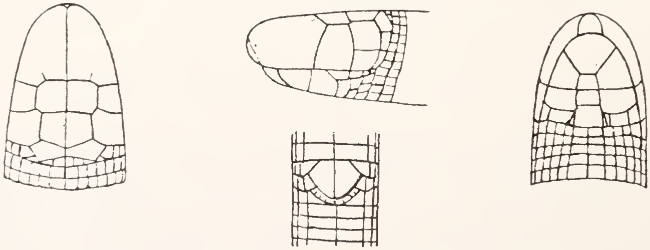

Fig. 16. *Amphisbaena schaeferi* (Type after Sternfeld).

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no

frontal; a pair of postfrontals; a pair of parietals; a pair of occipitals; no supraocular; no preocular; no ocular, eye hidden; 1 (third) upper labial; 2 large temporals; mental elongate ? (Sternfeld states that the type is damaged and that the drawing may be erroneous); 250 annuli on body, 27 on tail; 22 (12 + 10) segments in a midbody annulus, the 2 median segments about two times as broad as long; 2 anals; 0 preanal pores.

Measurements. Total length 219 (186 + 23) mm.

Distribution. **Cameroon:** Japoma. (Known only from the type in the Berlin Museum).

Amphisbaena quadrifrons quadrifrons Peters

1862a. *Amphisbaena quadrifrons* Peters, Ber. Akad. Wiss. Berlin, p. 25: Neu Barmen, Hereroland, South West Africa.
1869b. Peters, p. 661.
1879b. Peters, p. 277, pl. –, fig. 4.
1881. Strauch, p. 412.
1885e. Boulenger, p. 447.
1898. Sclater, p. 104.
1910a. Hewitt, pp. 60, 69.
1910a. Werner, p. 327.
1910b. Werner, p. 41.
1911. Lampe, p. 167.
1911b. Sternfeld, p. 403.
1911d. Sternfeld, p. 25.
1913. Hewitt and Power, p. 155.
1914a. Nieden, p. 450.
1915c. Werner, p. 339.
1930. FitzSimons (part), pp. 33, 34.
1935b. FitzSimons (part), p. 353.
1936c. Parker (part), p. 140.
1938. FitzSimons (part), p. 194.
1872. *Cynisca quadrifrons* Gray, p. 36.
1931. ? *Amphisbaena ambuellensis* Monard, Bull. Soc. Neuchatel Sci. Nat., **55**, p. 93, figs. 1–4: Chimporo and Kakindo (Caquindo), Angola.
1937b. ? Monard, p. 65, fig. 3, no. 1.

Description. Rostral moderate, triangular; nasal forming a suture with its fellow behind the rostral; a pair of prefrontals, separated from the first and second labials; no frontal; a pair of postfrontals; a pair of small parietals, rarely subdivided; a pair of small occipitals, rarely subdivided; no supraocular, but a preocular which extends above ocular and is in contact with a prefrontal and postfrontal above, a

nasal before, and a first and second labial below; ocular moderate, eye distinct; 3 upper labials, third largest; 3–6 large temporals, upper in contact with a postfrontal, parietal and occipital, and anteriorly with ocular and third labial; mental moderate, subquadrangular; 3 lower

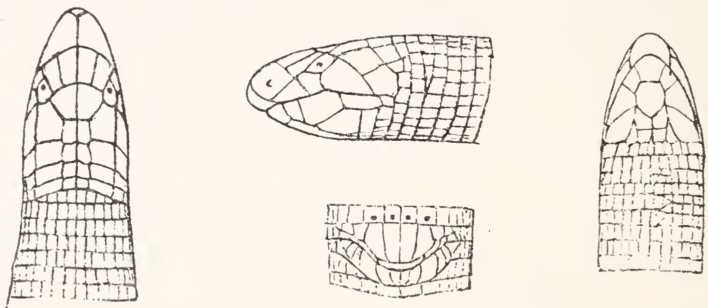

Fig. 17. *Amphisbaena quadrifrons quadrifrons* (Type after Peters).

labials, first small, second very large; postmental elongate; 2 chin shields separated by a large sublabial from the lower labials, or 4 chin shields, outer in contact with second lower labial; 221–242 annuli on body, 41–50 on tail; 33–38 (17–22 + 16–22) segments in a midbody

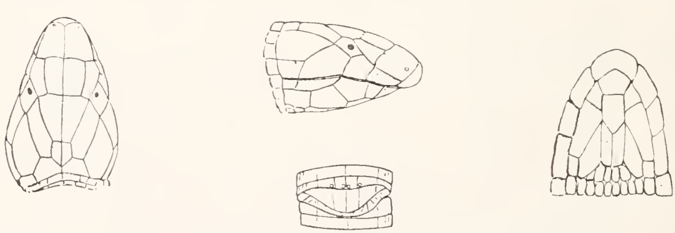

Fig. 18. *Amphisbaena ambuellensis* (Type after Monard). Here considered a synonym of *A. q. quadrifrons Peters.*

annulus, the 2 median ventral segments about two times as broad as long; 4–6 anals; 4 preanal pores.

Dentition. "Premaxillary teeth 2; maxillaries 3–3; mandibulars 5–5," is given by Monard for *ambuellensis* but is almost certainly based on a defective series, *cf.* allied species.

Measurements. Total length 208 (176 + 32) mm.[1]

[1] Exceeded by Werner's (1910a, p. 327) extraordinary measurement of 396 mm. for a specimen from Vlei Topan, British Bechuanaland!

Habitat. Usually found beneath stones and logs on the sand veld. On being exposed they immediately burrow out of sight.

Distribution. **Bechuanaland Protectorate:** Chukudu; Gemsbok; Gomodimo; Kaotwe Pan; near Khakhea; Mabeleapudi; near Machumi Pan; Mochudi; Molepolole; Mothatlogo; Severelela; Shaleshonto; Sunnyside; Topan Vlei. **South West Africa:** Damaraland; Grootfontein; Hereroland: Neu Barmen; Hoffnung; Liebig's Ranch; Namutoni; Okahandja; near Okaukuejo; Otjituezu Farm near Neudamm; Outgo; Tsaobis; Windhuk. **Angola:** Chimporo; Kakindo.

Remarks. It is with some misgivings that I tentatively synonymize the three cotypes of *ambuellensis* with *quadrifrons*, for if the postfrontal-occipital arrangement as figured by Monard (see text-fig. 18 in this paper) should prove constant in Angola, then the recognition of an Angolan race would be justified. The condition, however, is approached by such specimens as M. C. Z. 42,867 from Lukafu, Belgian Congo, a locality where normal arrangement of these shields predominates among *A. q. capensis* which is so abundant there. As the species is particularly liable to unilateral subdivision of these head shields, I doubt the probability of Angolan examples being more stable. Nor, so far as my experience goes, is it usual to find racial differentiation as between the fauna of southern Angola and that of South West Africa. The alleged difference cited by Monard in his later paper (1937b, p. 66) is really one of interpretation, the scale he designates as a fourth upper labial is here called a lower temporal.

Comments on the reasons for recognising the race *capensis* will be found below.

Amphisbaena quadrifrons capensis Thominot

1887b. *Amphisbaena quadrifrons* Boettger (not of Peters), p. 144.
1893a. Boettger, p. 77.
1894e. Boulenger, p. 724.
1910b. Boulenger, p. 472.
1910. Peracca, p. 1.
1912. Peracca, p. 2.
1920b. Angel, p. 614.
1930. FitzSimons (part), pp. 33, 34.
1933m. Witte, p. 72.
1934a. Cott (part), p. 160.
1934. Pitman, p. 304.
1935a. FitzSimons, p. 535.

1935b. FitzSimons (part), p. 353.
1936c. Parker (part), p. 140.
1938. FitzSimons (part), p. 140.
1887. *Amphisbaena capensis* Thominot, Bull. Soc. Philom. Paris (7), **11**, p. 188: Lake Ngami, Bechuanaland Protectorate.
1910b. Werner, p. 41.
1930c. *Amphisbaena violacea* Witte (not of Peters), p. 85.
1931b. [1]*Monopeltis quadrifrons* Witte, p. 41 (misprint for *Amphisbaena*).

Description. Essentially similar to the typical form except that there are 198–221 annuli on body, 38–50 on tail; 29–38 (15–20 + 12–18) segments in a midbody annulus.

Measurements. Total length (Lukafu, Congo) 259 (221 + 38) mm.

Distribution. **Mozambique:** Charre. **Southern Rhodesia:** Chirinda Forest; Mtoko. **Northern Rhodesia:** Lake Bangweulu; Lealui; Sesheke in Barotseland. **Bechuanaland Protectorate:** Kabulabula; Lake Ngami; Noi Xas near Ghanzi. **Transvaal:** Pietersburg. **Cape Province:** Daniels Kuil; Kuruman; Warrandale. **Belgian Congo:** Flandria in Equateur Province; Kakyelo; Luapula River near Sekantui; Lukafu.

The respective ranges of the two forms would appear to be as follows: *A. q. quadrifrons* South West Africa east to the vicinity of Lake Ngami and Kuruman where it meets with *A. q. capensis* which ranges eastward to Mozambique and northeast to the Luapula River in southeast Belgian Congo.

Remarks. FitzSimons, Cott and Parker have all drawn attention to the wide range in number of body annuli presented by *quadrifrons.* On making a list of the limits of variation for every species in the genus, I found that none exceeded 28 with the exception of *quadrifrons* which showed 45. It seemed probable therefore that a southwestern and eastern, or northeastern, form might be recognised, the latter with 198–221 annuli, the other with 221–242.

Most unfortunately a name (*capensis*) is available for the eastern form for the type came from the extreme western limits of its range, *i.e.* Lake Ngami, an area where one may expect to encounter intermediates. The type of *capensis* was said to have "about 210" annuli on body, each annulus being composed of 28 (16 + 14) segments. As the sum of 16 and 14 is 30, it is difficult to know which figure is incorrect.

[1] Though this record from Flandria, Equateur Province, is far north of the range, Dr. de Witte, having reexamined the specimen, assures me that both locality and its identification with *quadrifrons* may be relied upon.

Angel (1920b, p. 614) records that one of his three specimens differs from the other two, which agree precisely with Peter's figure, in that the two large temporals, instead of being separated by the nuchals, meet to form a long suture on the median line.

AMPHISBAENA VIOLACEA Peters

1854. *Amphisbaena violacea* Peters, Ber. Akad. Wiss. Berlin, p. 620: Inhambane and Lourenco Marques, Mozambique.
1855. Peters, p. 49.
1862. Peters, p. 26.
1881. Strauch, p. 411.
1882. Peters, p. 85, pl. xiii, figs. 2–2h.
1885e. Boulenger, p. 446.
1896a. Bocage, p. 99.
1898. Sclater, p. 104.
1908b. Boulenger, p. 225.
1910b. Boulenger, p. 472.
1910a. Hewitt, pp. 60, 70.
1910b. Werner, p. 41.
1930. FitzSimons, p. 34.
1872. *Cynisca ? violacea* Gray, p. 36.
1930. *Amphisbaena vandami* FitzSimons, Ann. Transvaal Mus., **14**, p. 32, figs. 11–14: Louw's Creek, Barberton district, Transvaal.

Description. Rostral moderate, triangular; nasal forming a suture with its fellow behind the rostral; a pair of prefrontals, in contact with

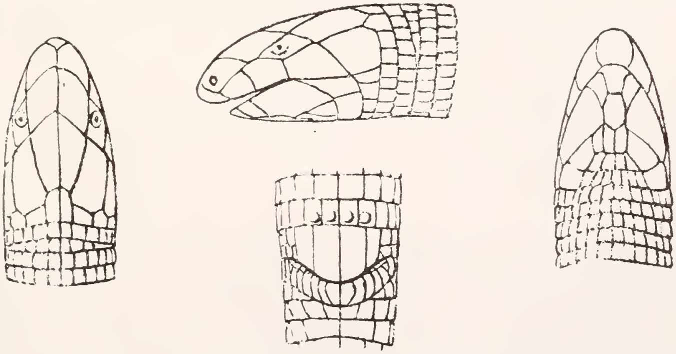

Fig. 19. *Amphisbaena violacea* (Type after Peters).

first and second labials; no frontal; a pair of postfrontals; a pair of small parietals; a pair of small occipitals; no supraocular; no preocular;

an ocular, eye distinct; 3 upper labials, third largest; 2–6 large temporals (subject to division), upper in contact with a postfrontal, parietal, occipital, and anteriorly with the ocular and third labial; mental moderate, subquadrangular; 3 lower labials, first small, second very large; postmental elongate, heptagonal; 2 chin shields, separated by a large sublabial from the lower labials, or anteriorly in contact with second lower labial; 181–202 annuli on body, 46–59 on tail; 28–38 (16–20 + 14–18) segments in a midbody annulus, the 2 median ventral segments slightly broader than long; 4–6 anals; 4 preanal pores.

Dentition. Premaxillary teeth 7, maxillaries 4–4; mandibulars 7–7.

Measurements. Total length 198 (153 + 45) mm.

Distribution. **Mozambique:** Inhambane; Lourenco Marques. **Transvaal:** Barberton district: Louw's Creek. **Zululand**: Kosi Bay. (Type of ***violacea*** in the Berlin Museum, ***vandami*** (T. M. 4279) in the Transvaal Museum).

Remarks. Boulenger's (1910b, p. 472) inclusion of Bechuanaland in the range of this coastal species, was based on his incorrect synonymizing of *capensis* from Lake Ngami with *violacea* instead of with *quadrifrons*. Witte's (1930c, p. 85) record of *violacea* from Lake Bangweulu, Northern Rhodesia, is assumed to be a misidentification for *quadrifrons*.

AMPHISBAENA PHYLOFINIENS Tornier

1899a. *Amphisbaena phylofiniens* Tornier, Zool. Anz., **22**, p. 260: Ujiji, Tanganyika Territory.
1900b. Tornier, p. 591.
1910b. Werner, p. 40.
1913c. Nieden, p. 75.
1923d. Loveridge, p. 851.
1924b. Loveridge, p. 11.
1937f. Loveridge, p. 495.

Description. Rostral moderate, triangular; nasal forming a suture with its fellow behind the rostral; a pair of prefrontals, in contact with first and second labials; no frontal; a pair of postfrontals; a pair of large parietals in contact on the median line; a pair of small occipitals (in the first annulus); no supraocular; no preocular; no ocular, eye hidden; 3 upper labials, third largest; 3 temporals, the anterior very large, its upper edge in contact only with a parietal; mental moderate, rounded posteriorly; 3 lower labials, third largest; postmental elongate,

shield-shaped; 2–4 chin shields, the outer in contact with the second and third lower labials; 244–260 annuli on body, 6–20 on tail; 30–32 (14–16 + 16–17) segments in a midbody annulus, the 2 median ventral segments slightly broader than long; 10–12 anals; 6 preanal pores.

Measurements. Total length 203 (185 + 18) mm.

Habitat. Occurs in sandy soil in the low-lying rice fields of Ruanda, a few miles east of Ujiji.

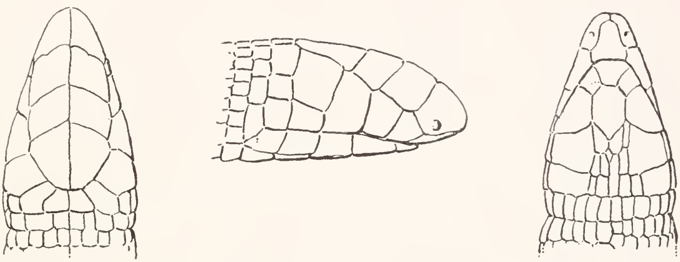

Fig. 20. *Amphisbaena phylofiniens* (Topotype ♀ M.C.Z. 47901).

Distribution. **Tanganyika Territory:** Ujiji and vicinity.

Remarks. Known only from the two cotypes in the Berlin Museum, and four examples in the Museum of Comparative Zoölogy. I was informed by the District Officer, Mr. J. R. Johnston, that he had seen a specimen of this rare amphisbaenid in sandy country near Lake Tanganyika at least twenty miles south of Ujiji.

AMPHISBAENA MPWAPWAENSIS Loveridge

1932a. *Amphisbaena mpwapwaensis* Loveridge, Bull. Mus. Comp. Zoöl., **72**, p. 378: Mpwapwa, Ugogo, Tanganyika Territory.

1933h. Loveridge, p. 304, pl. iii, fig. 1.

1937f. Loveridge, p. 495.

Description. Rostral moderate, triangular; nasal fused with first labial, preocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals; a pair of parietals; a pair of occipitals; no supraocular; no preocular; an ocular separating postfrontal from anterior labial, eye hidden; 2 (second and third) upper labials, posterior largest; 2–3 moderate temporals, upper in contact with postfrontal, parietal, posterior labial and other temporals; mental elongate, subtriangular;

3 (or 2) lower labials, first very large, second small; postmental small; 4 (not 3) chin shields; 269–273 annuli on body, 26 on tail; 30 (14 + 16) segments in a midbody annulus; 6 anals; 5–6 preanal pores.

Measurements. Total length of ♂, 194 (175 + 19) mm., of ♀, 162 (147 + 15) mm.

Fig. 21. *Amphisbaena mpwapwaensis* (Type ♂ M.C.Z. 30767).

Habitat. Taken by digging in dry earth beneath a fallen tree lying beside the stream which meanders past the front of the Veterinary Headquarters office, built in 1929.

Distribution. **Tanganyika Territory:** Central Province: Mpwapwa. (Known only from the types (M.C.Z. 30767–8) in the Museum of Comparative Zoölogy, Cambridge, Massachusetts).

AMPHISBAENA EWERBECKI (Werner)

1910b (1909). *Chirindia ewerbecki* Werner, Mitt. Zool. Nat. Mus. Hamburg, **27**, p. 37: Mbanja (Banja), ten miles north of Lindi, Tanganyika Territory.
1923d. Loveridge, p. 651.
1924b. Loveridge, p. 11.
1937f. Loveridge, p. 493.

Native name. *Mbitu* (Kimakonde, but applied to *Leptotyphlops* also).

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals[1] (followed by a pair of temporals broadly in contact on the median line and followed by) a pair of parietals; 1–2 pairs of poorly defined occipitals (in first annulus); no supraocular; no preocular; no ocular, eye usually distinguishable under posterior

[1] Left prefrontal fused with left temporal in one ♀ topotype.

edge of fused nasal[1]; 1 (third) upper labial in contact with postfrontal; 2–3 temporals, upper in contact with postfrontal, parietal, labial and anterior lower temporal; mental elongate, subtriangular; 3 lower labials, first very large, second very small; postmental small; 2 + 3, 3 + 3 and 2 + 4 chin shields; 264–280[2] annuli on body; 25–28 on tail; 22–24 (10–12 + 12) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 6 anals, the outer ones frequently subject to division; 6 preanal pores in male, 0 in female.

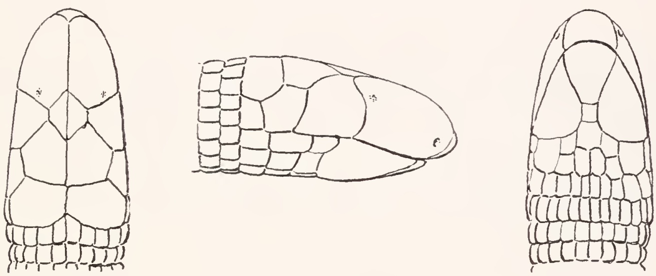

Fig. 22. *Amphisbaena ewerbecki* (Topotype ♀ M.C.Z. 47907).

Dentition. Premaxillary teeth 7; maxillaries 4–4; mandibulars 7–7.

Measurements. Largest ♂ (M. C. Z. 47922) measures 150 (133 + 17) mm., largest ♀ (M. C. Z. 47934) measures 154 (137 + 17) mm.

Breeding. A ♀, taken on April 27, 1939, held a single enormously elongate egg, measuring 31 x 2 mm.

Habitat. Fifty of the Mbanja topotypes in the collection of the Museum of Comparative Zoölogy, were dug from the red laterite soil on the Mitonga aerodrome, altitude about 90 feet. Twenty more were found in the sandy soil of the adjacent native mahoga gardens, some being secured by digging deeply beneath logs. The solitary specimen obtained at Lindi, was lying on the surface beneath palm leaves in a sandy side street in the northern part of the town. Our success in finding these amphisbaenids within two feet of the surface was almost certainly due to the heavy rains at that time (April 26 to May 5).

Distribution. **Tanganyika Territory:** Southern Province: Lindi, and Mbanja, the latter being about fifty miles in a straight line from the type locality of *A. rondoensis*, its nearest relative.

[1] "Under labial" according to Werner, is incorrect.

[2] "about 290" according to Werner, I have examined the type, however, which is in too poor a state of preservation for one to make an accurate count.

Remarks. Scale-counts have been made on the type, forty-four topotypes, and a Lindi specimen. All had 12 ventral segments in a midbody annulus, thirty-seven had 12 dorsal segments while only seven had 10 or 11 segments, two others were uncountable. None had lost their tails, but four had 10 annuli only, leading to the assumption that they were regenerated. Presuming that all poreless individuals are females, we find only twelve males to thirty-four females: in this connection see the percentage of males in the next species — *rondoensis.*

AMPHISBAENA RONDOENSIS spec. nov.

Type. Museum of Comparative Zoölogy, No. 47,951. An adult ♂ from Nchingidi, 2,700 feet, Rondo Plateau, Southern Province, Tanganyika Territory. Collected by Arthur Loveridge, May 9–19, 1939.

Paratypes. Museum of Comparative Zoölogy, Nos. 47,952–47,999, being forty seven specimens with the same data as the type.

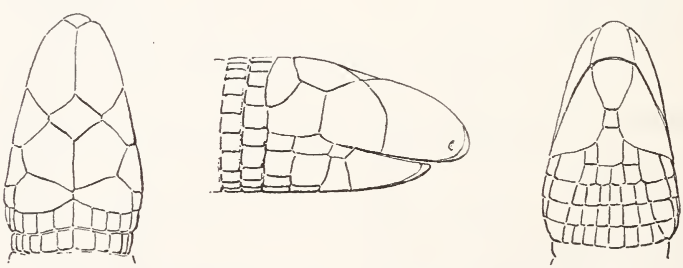

Fig. 23. *Amphisbaena rondoensis* (Type ♂ M.C.Z. 47951).

Diagnosis. Nearly related to *A. ewerbecki* (Werner) from which it differs in invariably possessing 10 dorsal and 10 ventral segments in a midbody annulus, 227–247 annuli on body and 24–28 on tail.

Native name. Liviluvilu (Kimera).

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals (followed by a pair of temporals broadly in contact on the median line and followed by) a pair of parietals; 1–2 pairs of poorly defined occipitals (in first annulus); no supraocular; no preocular; no ocular, eye usually distinguishable under posterior edge of fused nasal; 1 (third) upper labial narrowly in contact with

postfrontal; 2 (17 ex.) or 3 (30 ex.) temporals, upper broadly in contact with its fellow on the median line, lower (sometimes divided to give off a small posterior one) immediately posterior to the single surviving labial (it might well be mistaken for a labial), in one specimen (M. C. Z. 47991) what would have been a third temporal has fused with the parietal above it; mental elongate, subtriangular; 3 lower labials, first very large, second very small; postmental small; 2 + 4 chin shields; 227–247 annuli on body; 23–28 on tail; 20 (10 + 10) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 6 anals, the outer ones frequently subject to division; 6 preanal pores in male, 0 in female.

Dentition. Premaxillary teeth 7; maxillaries 4–4; mandibulars 6–6.[1]

Coloration. In life, vivid flesh pink. In alcohol, pallid pink.

Measurements. Largest ♂ (Type. M. C. Z. 47,951) measures 140 (122 + 18) mm., largest ♀ (Paratype. M. C. Z. 47,952) measures 146.5 (129 + 17.5) mm. Males average smaller than females.

Habitat. The entire series were obtained by my own collector digging in the sandy and laterite soil beneath rotting logs or matted vegetation at the edge of the primary forest within a square mile of my camp in the clearing known as Nchingidi.

Distribution. **Tanganyika Territory:** Southern Province: Rondo Plateau: Nchingidi, about fifty miles southwest of Lindi. (Known only from the 49 specimens listed above).

Remarks. Scale-counts have been made on all forty-nine specimens except that a score only were utilised in the counting of midbody annuli, which were not found to vary. Five had lost their tails, several having been cut by the hoe of my native collector; eight others had from 10 to 14 annuli only, leading me to assume that the tails were truncated and regenerated at the tip. Presuming that all poreless individuals are females, we find that this sex predominates surprisingly, there being only twelve males to thirty-six females.

I attribute my good fortune in securing such a series to the fact that the "big rains" were on, at which time it is possible for these delicate little creatures to approach the topsoil. Also to the persistence with which my collector searched for them for about three hours daily. None was brought in by local natives.

[1] I take this opportunity of expressing my indebtedness to Dr. R. Zangerl (University of Detroit) for clearing skulls of this and the preceding species, and to Dr. J. H. Waterman (Harvard University) for the illuminating technique which made counts of these diminutive teeth possible.

Amphisbaena orientalis (Sternfeld)

1911a. *Amphisbaenula orientalis* Sternfeld, Sitz. Ges. Naturf. Freunde Berlin, p. 246: Mikindani, s. e. Tanganyika Territory.
1913c. Nieden, p. 75.
1923d. Loveridge, p. 851.
1924d. Loveridge, p. 11.
1937f. Loveridge, p. 493.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals; a pair of parietals; 2 pairs of occipitals;

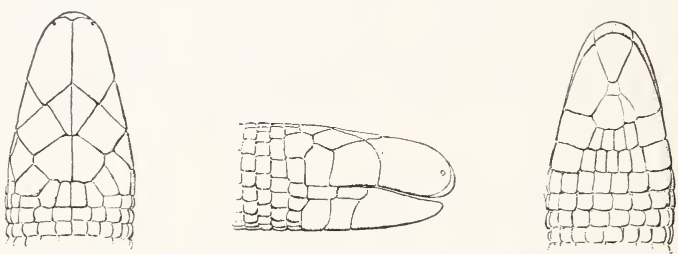

Fig. 24. *Amphisbaena orientalis* (Cotype ♀ M.C.Z. 21904).

no supraoculars; no preocular; no ocular, eye distinguishable under posterior edge of fused nasal; 1 (third) upper labial in contact with postfrontal (or separated by the upper anterior temporal in a topotype); 3 temporals, upper in contact with postfrontal, parietal, labial and other temporals (rarely also the nasal in a topotype); mental elongate, subtriangular; 3 lower labials, first very large, second very small; 2 + 3 or 2 + 4 chin shields; 257–260 annuli on body; 24–26 on tail; 22 (12 + 10) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 6 anals; 5–6 preanal pores present in males, absent in females.

Measurements. Total length 165 (142 + 23) mm.

Habitat. Occurs in red soil on the factory site to the north of the township.

Distribution. **Tanganyika Territory:** Mikindani. (Known only from the cotypes in the Berlin Museum and Museum of Comparative Zoölogy, and a topotype in the latter collection).

AMPHISBAENA BUSHBYI (Cott)

1934a. *Chirindia bushbyi* Cott, Proc. Zool. Soc. London, p. 158, fig. 2: Amatongas, Mozambique.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals; a pair of parietals; 2 pairs of occipitals; no

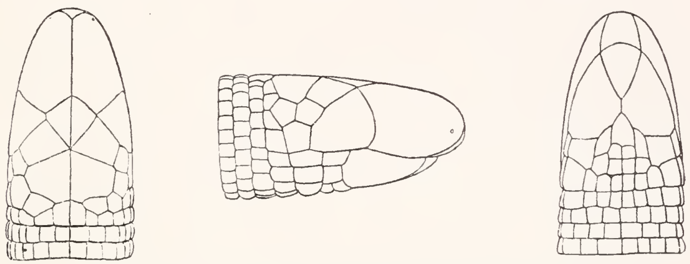

Fig. 25. *Amphisbaena bushbyi* (Type after Cott).

supraocular; no preocular; no ocular, eye hidden; 4 temporals, upper largest, *meeting its fellow in a point between the postfrontals and parietals* (this scale is called postfrontal by Cott); mental elongate, subtriangular; 3 lower labials, first very large, second very small; postmental small, separated from mental by anterior lower labials which form a suture; 4 chin shields, outer extending forward to contact with anterior lower labial and partly flank the postmental; 235 annuli on body, 27 on tail; 24 (12 + 12) segments in a midbody annulus, the 2 median ventral segments more than two times as broad as long; 6 anals; 0 preanal pores.

Measurements. Total length 95 (85 + 10) mm.

Distribution. **Mozambique:** Amatongas. (Known only from the type in the British Museum).

AMPHISBAENA SWYNNERTONI (Boulenger)

1907g. *Chirindia Swynnertoni* Boulenger, Ann. Mag. Nat. Hist. (7), **20**, p. 48, fig.: Chirinda Forest, Mashonaland, Southern Rhodesia.
1910b. Boulenger, p. 472.
1934. Pitman, p. 304.
1939b FitzSimons, p. 32.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals, *followed by a pair of temporals,* then a pair of parietals; 2 pairs of occipitals; no supraocular; no preocular; no ocular, eye hidden; 1 (third) upper labial, in contact with postfrontal; 5 temporals, upper largest, forming a long suture with its fellow on the median line between the postfrontals and parietals; mental elongate,

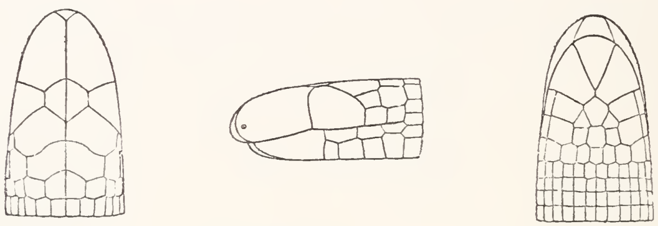

Fig. 26. *Amphisbaena swynnertoni* (Type after Boulenger).

subtriangular; 3 lower labials, first very large, second very small; postmental small, separated from mental by junction of anterior lower labials; 2–4 chin shields, the anterior pair separated by the postmental and in contact with the second lower labial; 246 annuli on body, 24 on tail; 24 (12 + 12) segments in a midbody annulus, the 2 median ventral segments about two times as broad as long; 2 anals, the others being broken up and the condition possibly abnormal; 0 preanal pores.

Measurements. Total length 135 (121 + 14) mm.

Distribution. **Southern Rhodesia:** southeast Mashonaland: Chirinda. (Known only from the type in the British Museum).

Enemies. The type was recovered from the stomach of a kingfisher (*Halcyon albiventris orientalis*) as mentioned by Swynnerton (1908, Ibis (9), **2**, p. 402.)

Habitat. Further particulars have been furnished by the late Mr. Swynnerton in a letter dated 18. viii. 1937. He writes: "The bird was shot in the outskirts of the Chirinda forest, which is on red loam derived from dolerite. About 300 yards from where the bird was shot one comes out on to sandstone-shale and grey sandish soil, but it is also a fact that during my many years residence there I found several amphisbaenians in the red loamy soil."

Mr. V. FitzSimmons recently visited the type locality in December and made prolonged, though unsuccessful, search for this interesting species.

Amphisbaena langi (FitzSimons)

1939a. *Chirindia langi* FitzSimons, Ann. Transvaal Mus., **20**, p. 8, figs. 5–8: Punda Maria, near Pafuri River in northeastern Transvaal.

Description. Rostral moderate, triangular; nasal fused with first labial, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal; a pair of postfrontals followed by a pair of parietals; 2 pairs of occipitals (only the posterior pair in first annulus); no supraoculars; no preoculars; no ocular, eye distinguishable beneath second labial[1]; 2 labials (second and third) in contact with postfrontal; 2 temporals, anterior in contact with postfrontal, parietal, (third) labial, posterior temporal and below by an enlarged scale; mental elongate, subtriangular or pyriform; 3 lower labials, first very large, second very small; postmental small, triangular, its apex directed anteriorly; 4 + 4 chin shields; 286–290 annuli on body; 30–32 on tail; 28 (14 + 14) segments in a midbody annulus, the 2 median ventral segments one and a half times as broad as long; 6 anals; 0 preanal pores.

Measurements. Type (T.M. 19,197) measures 128 (112.5 + 15.5) mm.

Distribution. **Transvaal:** Punda Maria. (Known only from the type and paratype, possibly both females, in the Transvaal Museum).

Remarks. The nomenclature of the scales used above differs from that employed in the original description for reasons stated on page 355. The triangular frontals of its describer are here called postfrontals, postfrontals become parietals, parietals and post parietals are occipitals. The fourth lower labial of the author is rejected as a labial being posterior to the buccal opening.

Genus Placogaster

1906i. *Placogaster* Boulenger, Ann. Mus. Civ. Stor. Nat. Genova (3), **2**, p. 203 (type *feae*).

Ventral segments about six times as broad as long. Otherwise characters as in Amphisbaena, with which it may have to be united in the event of intermediate forms being discovered.

Range. Sierra Leone to Portuguese Guinea.

[1] The first labial being lost through fusion with the nasal.

Synopsis of the Species

A frontal; an ocular; a pair of parietals; 4 chin shields; no preanal pores[1]..... *degrysi* (p. 400)

No frontal; no ocular; no parietals; no chin shields; 6 preanal pores[1]....*feae* (p. 401)

PLACOGASTER DEGRYSI spec. nov.

Type. Hamburg Museum. No. R. K. 1070, E. K. 13179, from Lagos, Sierra Leone, collected by Dr. H. Ulex in 1888.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular and prefrontal, forming a long suture with its fellow behind the rostral; no prefrontals; frontal small; a pair of postfrontals; a pair of parietals; no occipitals; no supraocular; no preocular; ocular large, eye distinct; 1 (third) upper labial; 2 temporals, upper very large, forming an extensive suture with a postfrontal and parietal; mental elongate; 2 lower labials, first very large, second small; no postmental; 4 chin shields, all of which are in contact with a first lower labial; 243 annuli on body, 26 on tail; 17 (10 + 7) segments in a midbody annulus, the median ventral segment six times as broad as long; 6 anals; 0 preanal pores.

Coloration. Above, pale brown; below, white.

Measurements. Total length 120 (107 + 13) mm.

Distribution. **Sierra Leone:** Lagos. (Known only from the holotype in the Hamburg Museum).

Remarks. Obviously derived from *Amphisbaena leonina* of Tumbo Island, French Guinea, from which it differs in having 26 annuli (instead of 20) on tail; in 17 (instead of 24) segments in a midbody annulus, the median ventral segments being 6 (instead of less than 2) times as broad as long; absence (instead of 3–6) of preanal pores; and of doubtful consequence, no postmental, it having divided longitudinally to form 4 chin shields.

Its points of difference with the more specialized *feae* have been stated in the Synopsis of the Species in the genus.

Named for Herr P. de Grys of the Hamburg Museum who so kindly lent me the specimen for study.

[1] Probably of sexual significance only.

Placogaster feae Boulenger

1906i. *Placogaster feae* Boulenger, Ann. Mus. Civ. Stor. Nat. Genova (3), **2**, p. 203, fig. 3: Cassine River district, Portguese Guinea.
1910b. Werner, p. 42.
1919. Schmidt, p. 601.

Description. Rostral moderate, triangular; nasal fused with first and second labials, preocular, ocular, prefrontal and frontal, forming a long suture with its fellow behind the rostral; no prefrontals; no frontal;

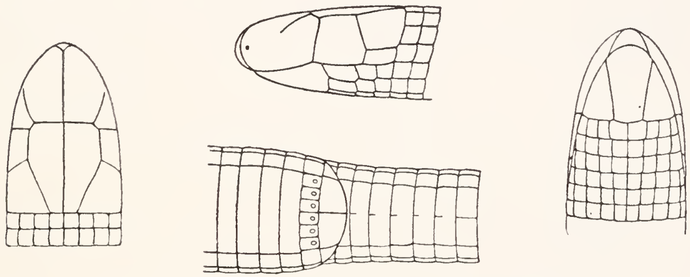

Fig. 27. *Placogaster feae* (Type after Boulenger).

a pair of elongate postfrontals; no parietals (obviously fused with postfrontals); no occipitals (obviously fused with postfrontals); no supraocular; no preocular; no ocular (its former position indicated by a groove), eye hidden; 1 (third) upper labial; 2 temporals, upper very large, forming an extensive suture with a postfrontal; mental elongate; 2 lower labials, first very large, second small; no postmental (obviously fused with mental); no chin shields; 252–258 annuli on body, 9–24 on tail; 19 (12 + 7) segments in a midbody annulus, the median ventral segment six times as broad as long; 4 anals; 6 preanal pores.

Coloration. Above, pale brown; below, white.

Measurements. Total length 175 (160 + 15) mm.

Distribution. **Portuguese Guinea:** Cassine River district. (Known only from the nine cotypes in the British and Genoa Museums).

Genus Geocalamus

1880. *Geocalamus* Günther, Ann. Mag. Nat. Hist. (5), **6**, p. 234 (type *modestus*).

Head compressed, snout laterally compressed but rounded; nostril lateral or slightly inferior, pierced in a small nasal; a gular fold; no vertebral line, a faint lateral line, no ventral line; pectoral segments slightly enlarged forming an angular series; preanal pores; tail cylindrical, obtuse.

Range. East Africa.

Synopsis of the Species

34–38 segments in a midbody annulus; 238–241 annuli on body, 29 on tail; 3 upper labials; 3–4 preanal pores . . . . *modestus* (p. 402)

38–42 segments in a midbody annulus; 209–222 annuli on body, 21–23 on tail; 3 upper labials; 4 preanal pores . . . . *acutus* (p. 403)

GEOCALAMUS MODESTUS Günther

1880. *Geocalamus modestus* Günther, Ann. Mag. Nat. Hist. (5), **6**, p. 234: Mpwapwa, Ugogo, Tanganyika Territory.
1885e. Boulenger, p. 453, pl. xxiii, fig. 5.
1910b. Werner, p. 42.
1913c. Nieden, p. 75.
1923a. Loveridge, p. 20.
1923d. Loveridge, p. 851.
1923h. Loveridge, p. 949.
1924b. Loveridge, p. 11.
1937f. Loveridge, p. 495.
1881. *Amphisbaena modesta* Strauch, p. 412.

Description. Rostral large, its posterior angle inserted between the prefrontals; nasal distinct, or incompletely separated from first labial anteriorly, between rostral, first and second labials, and prefrontal; a pair of prefrontals; frontal moderate, distinct, or incompletely separated from the prefrontals; a pair of postfrontals; no parietals (being fused with postfrontals); a pair of rudimentary occipitals; no supraocular; no preocular; ocular moderate, eye distinct; 3 upper labials, first small, second and third larger, subequal; 3–4 temporals descending to the commissure of the mouth; mental moderate, subquadrangular; 3 lower labials, first small, second and third subequal; postmental moderate; 4 chin shields in anterior row, 7 in posterior row, or outermost of the two rows fused to form an elongate sublabial; 238–241 annuli on body, 29 on tail; 34–38 (16–18 + 18–20) segments in a midbody annulus, the 2 median ventral segments nearly equilateral;

pectoral segments feebly differentiated, slightly longer than broad, forming an anteriorly-directed angular series; 6 anals; 3–4 preanal pores.

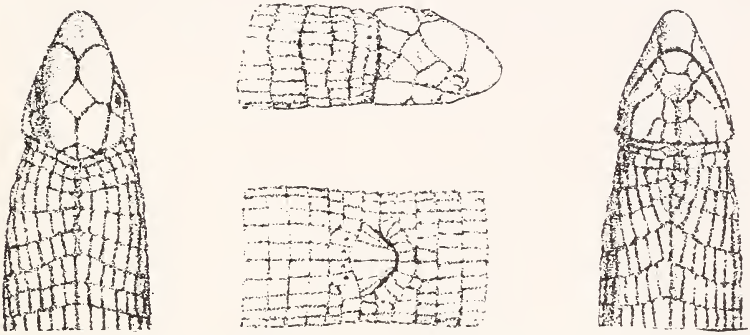

Fig. 28. *Geocalamus modestus* (Type after Boulenger).

Dentition. Premaxillary teeth 3, maxillaries 3–3, mandibulars 7–7.

Coloration. Above uniformly violet brown (plumbeous in life) except for the intersegmental grooves which are white; below pure white (somewhat transparent in life).

Measurements. Total length 274 (240 + 34) mm.

Enemies. A much chewed example was recovered from the stomach of a banded mongoose (*Mungos mungo colonus*) at Ushora.

Distribution. **Tanganyika Territory:** Ikikuyu and Mpwapwa in Ugogo; Ushora in Mkalama. (Known only from the three cotypes in the British Museum and two specimens in the Museum of Comparative Zoölogy).

Geocalamus acutus Sternfeld

1912c. *Geocalamus acutus* Sternfeld, Wiss. Ergebn. Deut. Zentral-Afrika-Exped. 1907–1908, **4**, p. 209: Voi, Kenya Colony.
1913c. Nieden, p. 75.
1923d. Loveridge, p. 851.
1923h. Loveridge, p. 949.
1924b. Loveridge, p. 11.
1936j. Loveridge, p. 300.
1913. *Geocalamus noltei* Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 366, pl. xxvi, fig. 6: Moshi, Tanganyika Territory.
1922a. Mertens, p. 173.

Native names. Kilimagonde (Kisagalla and Kiteita); *moore* (Kiteita, but this name was also applied to the local caecilian).

Description. Rostral large, its posterior angle inserted between the prefrontals; nasal distinct, between rostral, first and second labials, and prefrontal; a pair of prefrontals; frontal moderate (said to give off a small azygous scale posteriorly in the type of *noltei*); a pair of

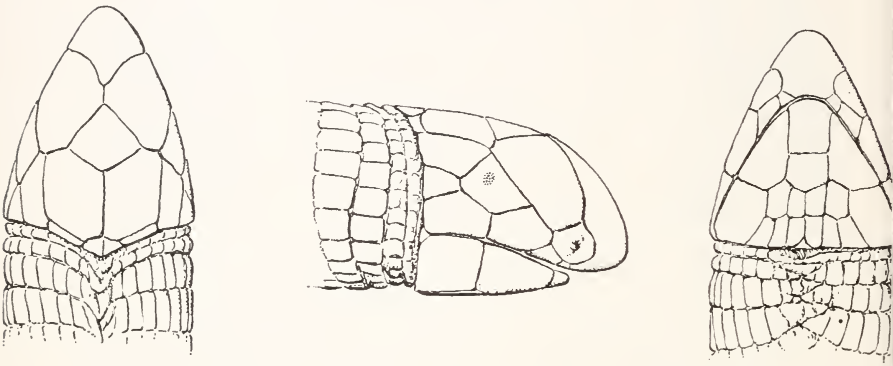

Fig. 29. *Geocalamus acutus* (Topotype ♀ M.C.Z. 41115).

postfrontals; no parietals (being fused with postfrontals); a pair of rudimentary occipitals present or absent; no supraocular; no preocular; ocular moderate, eye distinct or hidden; 3 upper labials, first small, second and third larger, subequal; 2–4 temporals descending to the commissure of the mouth; mental moderate, subquadrangular; 2 (very rarely 3) large lower labials, subequal or first smaller; postmental moderate; 4–5 chin shields in anterior row, 4–6 in posterior row; 209–222 annuli on body, 21–26 on tail (9 in injured type of *noltei*); 38–42 (18–20 + 20–22) segments in a midbody annulus, the 2 median ventral segments nearly equilateral; pectoral segments feebly differentiated, slightly longer than broad, forming an anteriorly-directed angular series; 6 (said to be 4 in type of *noltei*) anals, subject to much division; 4 preanal pores.

Coloration. Above uniformly violet brown (flesh-pink in life) except for the intersegmental grooves which are white; below pure white, or subcaudal segments mottled with brown.

Measurements. Total length of ♀, 281 (248 + 33) mm.

Breeding. No signs of gestation at Voi between April 7 and 13.

Diet. A large amphisbaenid held what was apparently a young worm or caecilian, another some skin of what may have been a caterpillar. In all there was much soil and grit which may have been ingested with food but possibly indicating that they swallow it like earthworms to obtain such nutriment as it may contain.

Habitat. In sandy soil on the flats at Msinga Estate not far from the Voi River.

Distribution. **Kenya Colony:** Samburu; Voi (restricted type locality). **Tanganyika Territory:** Moshi. (Known only from the two cotypes of *acutus* in the Berlin Museum, the type of *noltei*, No. 5453a, in the Senckenberg Museum, a Samburu specimen in the British Museum and sixteen topotypes in the Museum of Comparative Zoölogy).

Remarks. One of the cotypes appears in Sternfeld's paper as from "Deutsch Ostafrika, coll. Huebner". While it is possible that it may have been taken across the border, we know that Huebner lived at Kibwezi, west of Voi, and that most of the material collected by him was taken at Kibwezi. It seems at least possible that the second cotype came from one or other of these localities rather than from Tanganyika Territory.

With his accustomed kindness, Dr. R. Mertens has examined the type of *noltei* and reports that the four preanal pores are present, it is difficult to understand how Boettger overlooked them. In reply to my suggestion that the tail had suffered injury and the truncate portion had healed over, he says that this appears to be the case though it is difficult to speak with certainty. Elsewhere I have pointed out how difficult it is to distinguish between an original and a healed tail. Under these circumstances I have no hesitation in referring *noltei* to the synonymy of *acutus*, the paper was posthumously published sometime after Dr. Boettger's death.

Genus Monopeltis

1848. *Monopeltis* A. Smith, Ill. Zool. S. Africa, Rept., pl. lxvii (type *capensis*).
1852. *Phractogonus* Hallowell, Proc. Acad. Nat. Sci. Philadelphia, p. 62 (type *galeatus*).
1865. *Monotrophis* Gray, Proc. Zool. Soc. London, p. 454 (type *capensis*).

Head depressed, snout projecting, sharp-edged; nostril inferior, pierced in a usually-elongate nasal; a gular fold; no vertebral line, a lateral line, no ventral line; pectoral segments enlarged but subject to subdivision; preanal pores present or absent; tail cylindrical, obtuse. Teeth anchylosed to the sides of the jaws.

Coloration. The coloration of all species in this genus being uniform flesh-pink in life, colorless in alcohol, except for slight dusky mottling above in a few species, it has not been considered necessary to repeat it for each species.

Range. Tropical and northern South Africa.

Remarks. Owing to the variability of members of this genus, I have had considerable difficulty in devising a synopsis which would reflect taxonomic and geographical relationships. In view of the fact that the majority of species are still only known from the types makes it essential that considerable caution should be exercised in using the synopsis.

Even in the major character of head shields we find *guentheri*, normally with one, has both one or two at Stanley Falls. This same species may exhibit a preocular on one side of the head but not on the other, nevertheless this character appears to have some value being consistently absent in whole groups of species. Pectorals, as is obvious from a study of Bocage's figure of *anchietae* and its synonym *okavangensis*, are subject to such wide variation as to be useless for key purposes.

With the exception of an anomalous series of *capensis* from Ombujomatemba discussed later, the largest number of one species from a single locality which has been available for study, is one of seven *capensis* from Klipkvil Farm, Transvaal. These exhibit a range of 42–51 (*i.e.* 10) segments in a midbody annulus, FitzSimons, however, has recorded a range of 14 in his type series of the allied *M. vernayi*, and for its whole range it appears probable that *M. c. capensis* has a variability of 16.

Following Boulenger (1885e, p. 453, footnote) I count the longitudinal rows of annular rings from the back of the head to above the anus. In this character the seven Klipkvil specimens showed a range of 22, all the records of *M. c. capensis* together give 36, which does not seem unreasonable when compared with the older and better-known species from the west where we find *galeatus* with 34 and *anchietae* with a variability of 32. The number of annuli on the tail appears much less variable with 4 as a maximum range except in *galeatus* where I expect the higher count may be the result of differing methods or typographical errors.

It is interesting to note that all *Monopeltis* north of the Zambesi have 13 or more annuli on the tail, while all those south of the river have 12 or less. Unfortunately when an amphisbaenid loses the end of its tail the tip becomes rounded off so much like that of an intact

tail that only the most careful comparison reveals that the unexpectedly low count of annuli is really the result of an injury.

Synopsis of the Species

(For reasons explained in the foregoing remarks, in applying this synopsis a range of 15 segments in a midbody annulus, of 36 annuli on body, of 4 on tail, may be anticipated for every species.)

I. Two large shields covering the head (see *guentheri* and *c. capensis* also).

A. No preocular (see *jugularis* also).

70 segments in a midbody annulus; 289 annuli on body, 12 on tail; 1–1 preanal pores . . . . *mauricei* (p. 408)

40–54 segments in a midbody annulus; 198–224 annuli on body, 10–11 on tail; 0–0 preanal pores . . . . *vernayi* (p. 409)

36–46 segments in a midbody annulus; 182–222 annuli on body, 7–12 on tail; 0–0 or 1–1 preanal pores . . . . *anchietae* (p. 410)

42 segments in a midbody annulus; 289 annuli on body, 22 on tail; 0–0 preanal pores . . . . *remaclei* (p. 412)

30 segments in a midbody annulus; 234 annuli on body, 18 on tail; 1–1 preanal pores; no loreal . . . . *scalper* (p. 413)

B. A preocular (sometimes absent in *jugularis* and *galeata*).

32 segments in a midbody annulus; 227–233 annuli on body, 18–19 on tail; 0–0 preanal pores; a loreal . . . . *vanderysti* (p. 414)

34 segments in a midbody annulus; 215 annuli on body, ? on tail (damaged); 0–0 preanal pores . . . . *gerardi* (p. 415)

30–36 segments in a midbody annulus; 206–215 annuli on body, 13–17 on tail; 0–0 preanal pores . . . . *jugularis* (p. 416)

18 segments in a midbody annulus; 195–229 annuli on body, 17–22 on tail; 0–0, 1–1, or 2–2 preanal pores . . . . *galeata* (p. 417)

II. One large shield covering the head (sometimes two in *guentheri* and *c. capensis*).

A. A preocular (sometimes absent in *guentheri*).

28–38 segments in a midbody annulus; 246–254 annuli on body, 25–28 on tail; 3–3 or 4–4 preanal pores . . . . *guentheri* (p. 419)

32 segments in a midbody annulus; 276 annuli on body, 29 on tail; 5–5 preanal pores. . . . . *schoutedeni* (p. 420)

30–32 segments in a midbody annulus; 227 annuli on body, 19 on tail; 0–0 preanal pores. . . . . *lujae* (p. 421)

B. No preocular.

52–54 segments in a midbody annulus; 239–264 annuli on body, 10–11 on tail; 1–1 preanal pores. . . . . *c. gazei* (p. 422)

40–56 segments in a midbody annulus; 194–230 annuli on body, 8–12 on tail; 0–0 or 1–1 preanal pores. . . . . *c. capensis* (p. 423)

42–44 segments in a midbody annulus; 271–273 annuli on body, 9–11 on tail; 1–1 preanal pores . . . . *habenichti* (p. 426)

34 segments in a midbody annulus; 193 annuli on body, 11 on tail; 1–1 preanal pores; 3 lower labials. . . . . *decosteri* (p. 426)

32–34 segments in a midbody annulus; 198–204 annuli on body, 11–12 on tail; 1–1 preanal pores; 2 lower labials (as all other members of the genus have 3, perhaps *sphenorhynchus* represents an individual aberration, in this case *decosteri* would become a synonym). . . . *sphenorhynchus* (p. 427)

MONOPELTIS MAURICEI Parker

1935a. *Monopeltis mauricei* Parker, Ann. Mag. Nat. Hist. (10), **15**, p. 582, figs. 1–2: Monjalatsela, near Ghanzi, Bechuanaland Protectorate.

Description. Two large shields covering the head, the anterior once and a half times as long as the posterior; a pair of occipitals; no pre-

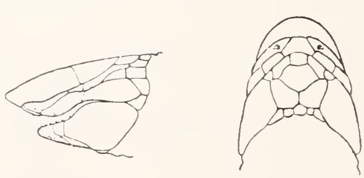

Fig. 30. *Monopeltis mauricei* (Type after Parker).

ocular; ocular small, eye indistinguishable; rostral separating the nasals, not bordering the nostrils; nasals elongate, reaching the ocular; 3 upper labials, third largest; mental small; postmental large, pentagonal, in contact with anterior lower labial; 2 chin shields, in contact

with all 3 lower labials; 289 annuli on body, 12 on tail; 70 (40 + 30) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 6 pectorals; 4 anals; 1–1 preanal pores.

Dentition. Premaxillary tooth 1; maxillaries 1–1; mandibulars 6–6.

Measurements. Total length 132 (127 + 5) mm.

Distribution. **Bechuanaland Protectorate:** Monjalatsela near Ghanzi. (Known only from the ♀ type (No. 1933.9.9.14) in the British Museum).

Monopeltis vernayi FitzSimons

1932. *Monopeltis vernayi* FitzSimons, Ann. Transvaal Mus., **15**, p. 36: Gomodimo, Kalahari, Bechuanaland Protectorate.

1935b. FitzSimons, p. 354, figs. 15–16.

Description. Two large shields covering the head, the anterior slightly longer than the posterior; a pair of occipitals; no preocular;

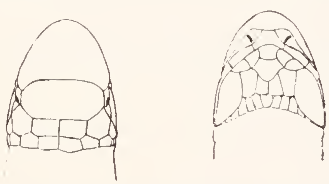

Fig. 31. *Monopeltis vernayi* (Type after FitzSimons).

ocular small, eye distinct; rostral separating the nasals, not bordering the nostrils; nasals elongate; 3 upper labials, third largest; mental small; postmental large, pentagonal, in contact with anterior lower labials; 4 chin shields, outer in contact with all 3 lower labials though barely with the anterior; 198–224 annuli on body, 10–11 on tail; 40–54 (22–28 + 18–26) segments in a midbody annulus, the 2 median ventral segments broader than long; 4–6 pectorals; 4 anals; 0–0 preanal pores.

Measurements. Total length 243 (231 + 12) mm.

Habitat. Excavated in the process of digging out gerbil burrows in typical Kalahari sand veld.

Distribution. **Bechuanaland Protectorate:** Gomodimo and Kuke. (Known only from the type (T.M. 14468) and paratype (F.M. 17268) in the Transvaal and Field Museums respectively).

Remarks. This species is of very doubtful status for reasons stated under *M. c. capensis.*

Monopeltis anchietae (Bocage)

1873c. *Lepidosternon* (*Phractogonus*) *Anchietae* Bocage, Jorn. Sci. Lisboa, **4**, p. 247, figs. 1–4: Humbe, Cunene River, Mossamedes, Angola.
1885e. *Monopeltis anchietae* Boulenger, p. 458.
1895a. Bocage, p. 28, pl. vii, figs. 1a–1c.
1897a. Bocage, p. 194.
1910a. Hewitt, p. 60.
1910b. Werner, p. 34.
1911b. Sternfeld, p. 403.
1911d. Sternfeld, p. 26.
1937b. Monard, p. 65.
1910a. *Monopeltis leonhardi* Werner, Denks. Med.-Nat. Ges. Jena, **16**, p. 328, pl. vi, figs. 2a–2c: Between Kgokong and Kang, Bechuanaland Protectorate.
1910b. Boulenger, p. 473.
1910b. Werner, p. 34.
1911d. Sternfeld, p. 26.
1910a. *Monopeltis quadriscutata* Werner, Denks. Med.-Nat. Ges. Jena, **16**, p. 328: Neitsas Farm, Grootfontein, South West Africa.
1910b. Boulenger, p. 473.
1910b. Werner, pp. 33, 38, 39.
1911d. Sternfeld, p. 26.
1915c. Werner, p. 340.
1938. FitzSimons, p. 194.
1931. *Monopeltis okavangensis* Monard, Bull. Soc. Neuchatel Sci. Nat., **55**, p. 95, fig. 5: Kakindo (Caquindo) & Villa da Ponte, Angola.
1937b. Monard, pp. 65, 68, fig. 3, no 2.
1937b. *Monopeltis devisi* Monard, Arqu. Museu Bocage, **8**, pp. 65, 69, fig. 3, no. 3: Mupa, Angola.

Description. Two large shields covering the head, the anterior much longer than the posterior; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral separating the nasals, not bordering the nostrils; nasals elongate, not reaching the ocular; 3 upper labials, third largest; mental small; postmental large, very variable, subhexagonal, flanked on either side by a small scale (*anchietae*), or transversely elongate and in contact with the first and second lower labials (*leonhardi*); 2–4 chin shields, outer in contact with second and third, or only third, or separated from all 3 lower labials as in the type of *anchietae;* [1] 182–222 annuli on body, 7–12 on tail (7 *fide* FitzSimons, 1938, p. 194); 36–46 (20–26 + 16–20) segments in a midbody annulus,

[1] 175 in type of *devisi*, possibly attributable to a difference in method of counting.

the 2 median segments broader than long; 4–6 pectorals; 4–5 anals; 0–0 or 1–1 preanal pores.

Measurements. Total length 284 (271 + 13) mm.

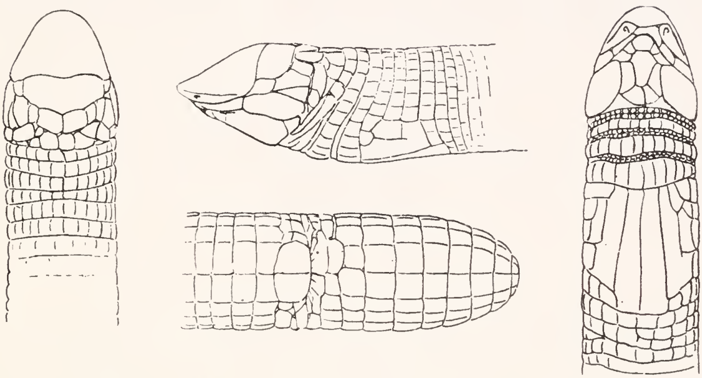

Fig. 32. *Monopeltis anchietae* (Type after Bocage).

Habitat. FitzSimons records his Waterberg specimen as having been "taken in moist loamy soil under stone at foot of mountains."

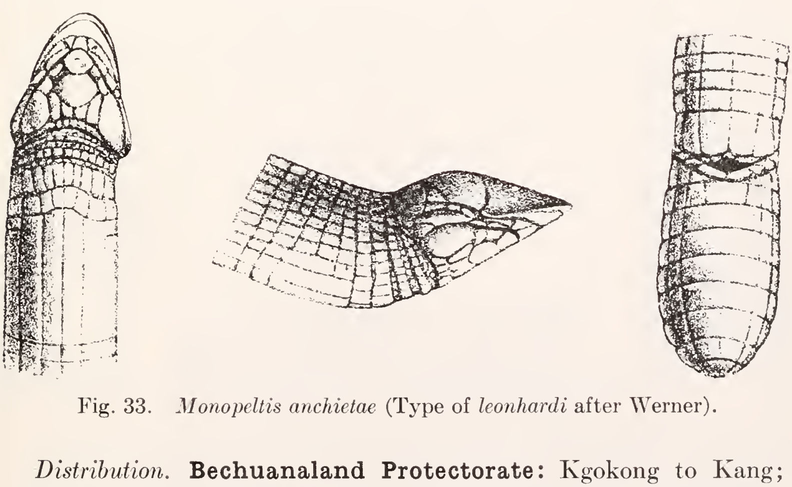

Fig. 33. *Monopeltis anchietae* (Type of *leonhardi* after Werner).

Distribution. **Bechuanaland Protectorate:** Kgokong to Kang; Palapye. **Cape Province:** Daniels Kuil near Kimberly; Little Namaqualand. **South West Africa:** Bethanien; Gobabis; Neitsas Farm;

Grootfontein district; Okahandja; Okawango; Waterberg. **Angola:** Humbe; Kakindo (Caquindo); Mupa; Villa da Ponte.

Remarks. As may be seen from the accompanying reproductions of Bocage's figures of the type of *anchietae,* there can be little doubt that the species was based on an aberrant individual. The describing

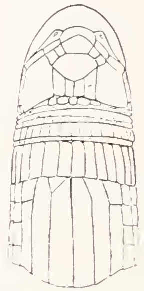

Fig. 34. *Monopeltis anchietae* (Type of *okavangensis* after Monard).

of *okavangensis* and *devisi* by Dr. Monard may be attributed to the overlooking of this and to the inadequate comparative material at his disposal. The relation of *anchietae,* as here understood, to *vernayi* and *capensis* is discussed under the latter.

Monopeltis remaclei Witte

1933c. *Monopeltis Remaclei* Witte, Revue Zool. Bot. Afr., **23**, p. 168, fig. 1: Lukulu, near Kiambi, Katanga, Belgian Congo.

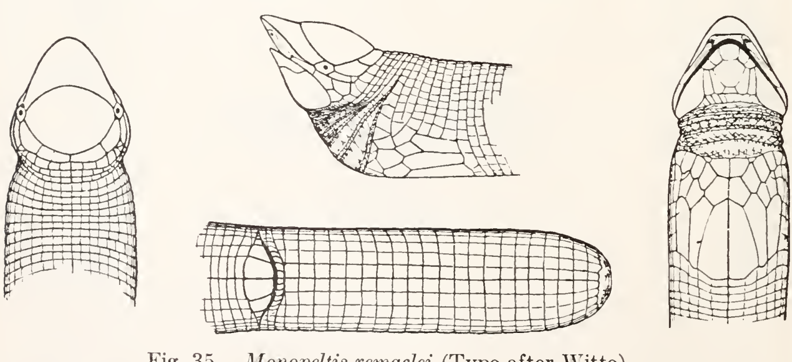

Fig. 35. *Monopeltis remaclei* (Type after Witte).

Description. Two large shields covering the head, the anterior much shorter than the posterior; a pair of occipitals; no preocular;

ocular small, eye distinguishable; rostral separating the nasals, bordering the nostrils; nasals elongate, not reaching the ocular; 3 upper labials, second longest, third highest; mental small; postmental large, pentagonal, in contact with the first and second lower labials; 5 chin shields, outer in contact with the second and third lower labials; [1]289 annuli on body, 22 on tail; 42 (26 + 16) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 6 pectorals; 4 anals; 0–0 preanal pores.

Measurements. Total length 560 (505 + 55) mm.

Distribution. **Belgian Congo:** Katanga: Lukulu near Kiambi. (Known only from the type (R.G. 8692) in the Congo Museum, Tervueren).

MONOPELTIS SCALPER (Günther)

1876. *Phractogonus scalper* Günther, Proc. Zool. Soc. London, p. 678, fig.: Angola.
1881. *Lepidosternum scalprum* Strauch, p. 469.
1885e. *Monopeltis scalper* Boulenger, p. 457, pl. xxiv, fig. 4.
1895a. Bocage, p. 29.
1910b. Werner, p. 34.

Description. Two large shields covering the head, the anterior slightly shorter than the posterior; a pair of occipitals; no loreal; no

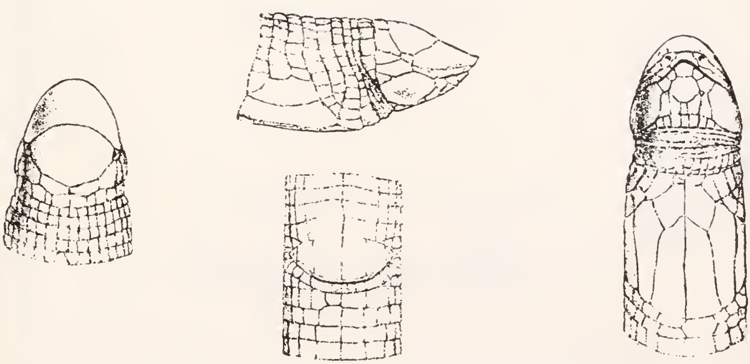

Fig. 36. *Monopeltis scalper* (Type after Boulenger).

preocular; ocular small, eye distinct; rostral separating the nasals, not quite bordering the nostrils; nasals elongate, apparently not reaching

[1] 389 in the original was a misprint, this suggestion has been confirmed by Dr. de Witte.

the ocular; 3 upper labials, third largest; mental small; postmental large, pentagonal, in contact with the first and second lower labials; 5 chin shields, outer in contact with the second and third lower labials; 234 annuli on body, 18 on tail; 30 (16 + 14) segments in a midbody annulus, the 2 median ventral segments much broader than long; 6 pectorals; 4 anals; 1–1 preanal pores.

Dentition. Premaxillary tooth 1; maxillaries 3–3; mandibulars 6–6.

Measurements. Total length 319 (290 + 29) mm.

Distribution. **Angola.** (Known only from the type in the British Museum).

Remarks. When more material is available for study, the possibility of *vanderysti* and *lujae* being aberrations of *scalper* should not be overlooked.

Monopeltis vanderysti Witte

1922a. *Monopeltis Vanderysti* Witte, Revue Zool. Afr., **10**, p. 66, pl. i, fig. 1: Wombali, Kwango district, Belgian Congo.

Description. Two large shields covering the head, the anterior slightly shorter than the posterior; a pair of occipitals; a loreal in ad-

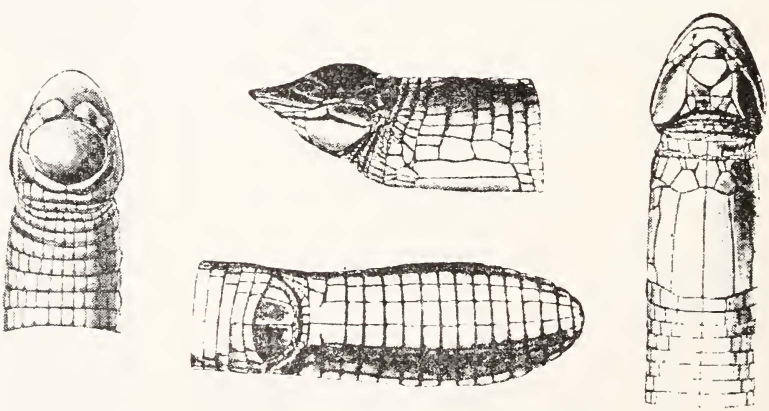

Fig. 37. *Monopeltis vanderysti* (Type after Witte).

vance of the preocular; ocular small, eye indistinguishable; rostral separating the nasals, bordering the nostrils; nasals elongate, not reaching the preocular; 4 upper labials, fourth largest; mental small; postmental large, pentagonal, in contact, even though barely, with all 3 lower labials; 2 chin shields, in contact with the third lower

labial; 227–233 annuli on body, 18–19 on tail; 32 (20 + 12) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 4–6 pectorals; 4 anals; 0–0 preanal pores.

Measurements. Total length 390 (365 + 25) mm.

Distribution. **Belgian Congo:** Kasai; Lake Leopold II; Leverville and Wombali in the Kwango district. (Known only from the four cotypes in the Congo Museum, Tervueren).

Remarks. Separable from *scalper* by the presence of a preocular and a loreal (called second preocular by Witte), concealed eye, 4 upper labials, and no preanal pores. See also remarks under *lujae* which may prove to be a synonym.

Monopeltis gerardi Boulenger

1913a. *Monopeltis Gerardi* Boulenger, Revue Zool. Afr., **3**, p. 392, figs. –: Kikondja, Katanga, Belgian Congo.

Description. Two large shields covering the head, the anterior slightly longer than the posterior; a pair of occipitals; a preocular; ocular small, eye distinct; rostral separating the nasals, not bordering

Fig. 38. *Monopeltis gerardi* (Type after Boulenger).

the nostrils; nasals elongate, reaching the preocular; 3 upper labials, third largest; mental small; post-mental large, subcordiform, in contact with the first and second lower labials; 4 chin shields, outer in contact with the second and third lower labials; 215 annuli on body, ? on tail (damaged); 34 (18 + 16) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 6 pectorals; 4 anals; 0–0 preanal pores.

Measurements. Total length 170+ mm. (tail damaged).

Distribution. **Belgian Congo:** Kikondja in Katanga. (Known only from the type in the Congo Museum, Tervueren).

Remarks. In view of its damaged tail, the assignment of *gerardi* to Monopeltis must remain uncertain. Dr. de Witte informs me that there are only 5 annuli left on the tail. Boulenger compared it with *gigantea* which is now referred to the genus Dalophia. The only difference from *jugularis,* from whose range it is separated by over a thousand miles, appears to be in the pectorals not being broken up.

Monopeltis jugularis Peters

1880a. *Monopeltis (Phractogonus) jugularis* Peters, Monatsb. Akad. Wiss. Berlin, p. 219, pl. –, fig. 1: West Africa.
1885e. Boulenger, p. 459.
1890a. Müller, p. 284.
1910a. Nieden, p. 235, fig. 1.
1910b. Werner, p. 34.
1919. Schmidt, p. 599.
1881. *Lepidosternon jugulare* Strauch, p. 469.
1881. *Lepidosternon Koppenfelsii* Strauch, Mél. Biol. Acad. Sci. St. Pétersbourg, **11**, p. 469: French Congo.
1885d. *Monopeltis capensis* (not of Smith) Müller, p. 781.
1885e. *Monopeltis koppenfelsii* Boulenger, p. 459.
1900b. Boulenger, p. 448.
1910b. Werner, p. 34.
1893d. *Monopeltis semipunctata* Boettger, Mitt. Geogr. Ges. Naturh. Mus. Lübeck (2), **5**, p. 89: Cameroon.
1897. Sjöstedt, p. 34.
1898. Werner, p. 207.
1902c. Tornier, p. 674.
1910b. Werner, pp. 33, 38, 39.

Description. Two large shields covering the head, the anterior equal to or slightly longer than the posterior; a pair of occipitals; preocular present (*koppenfelsii*) or absent (*jugularis, semipunctata*); ocular small, eye distinct or hidden; rostral separating the nasals, bordering the nostrils; nasal elongate, not reaching the preocular (when present); 3 upper labials, third largest; mental small; postmental large, subcordiform, in contact with the first and second lower labials; 4 chin shields, outer in contact with the second and third lower labials; 206–215 annuli on body, 13–17 on tail; 30–36 (16–19 + 14–18) segments in a midbody annulus, the 2 median ventral segments two to two and a half times as broad as long; pectorals broken up into large and small shields; 4–6 anals; 0–0 preanal pores.

Coloration. Above, brownish yellow anteriorly owing to a dark brown spot on each segment, posteriorly pale yellow; below yellowish.

Measurements. Total length 670 (640 + 30) mm.

Distribution. **French Cameroon:** Kribi. **French Congo:** (Gaboon). (Known from the types in the Berlin, Paris and Lübeck Museums, a Kribi specimen in the Berlin Museum, and three examples in the Hamburg Museum).

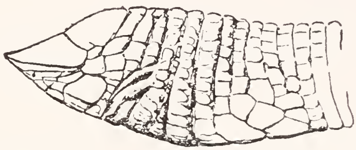

Fig. 39. *Monopeltis jugularis* (Type of *subpunctata* after Nieden).

Remarks. Nieden (1910a, p. 235), after direct comparison of the types of *jugularis* and *semipunctata* as well as with an intermediate specimen from Kribi, synonymized the two species, a conclusion at which I had independently arrived before reading Nieden's remarks. The upward-thrust head of *semipunctata* and the downward-thrust head of *jugularis* resulted in misleading their authors and the making of misstatements. Nieden's figure of the type of *semipunctata* shows a suture in front of the ocular indicative of where the preocular of *koppenfelsii* would be had not fusion taken place.

Monopeltis galeata (Hallowell)

1852. *Phractogonus galeatus* Hallowell, Proc. Acad. Nat. Sci. Philadelphia, p. 62, figs.: "Liberia" (error for Gaboon).
1856. Duméril, p. 424.
1857. Hallowell, p. 50 (corrects type locality).
1861. Duméril, p. 184.
1879. *Monopeltis* (*Phractogonus*) *magnipartitus* Peters, Monatsb. Akad. Wiss. Berlin, p. 276, footnote: Gaboon, i.e. French Congo.
1881. *Lepidosternum galeatum* Strauch, p. 465.
1881. *Lepidosternum Dumerilii* Strauch, Mél. Biol. Acad. Sci. St. Pétersbourg, **11**, p. 467: French Congo.
1881. *Lepidosternum magnipartitum* Strauch, p. 469.
1885e. *Monopeltis galeata* Boulenger, p. 457.
1910b. Werner, p. 34.
1919. Schmidt, pp. 599, 603.
1885e. *Monopeltis dumerilii* Boulenger, p. 457.

1900b. Boulenger, p. 448.
1910b. Werner, p. 34.
1913c. Werner, p. 15.
1885e. *Monopeltis magnipartita* Boulenger, p. 458.
1890d. Boulenger, p. 79.
1892. Müller, p. 212.
1900b. Boulenger, p. 448.
1906i. Boulenger, p. 204.
1910b. Werner, p. 34.
1919. Schmidt, p. 599.
1903. *Monopeltis unirostralis* Mocquard, Bull. Mus. Paris, **9**, p. 210: French Congo.
1910b. Werner, p. 34.
1919. Schmidt, pp. 599, 603.
1903. *Monopeltis Boveei* Mocquard, Bull. Mus. Paris, **9**, p. 211: French Congo.
1910b. Werner, p. 34.
1919. Schmidt, p. 599.

Description. Two large shields covering the head, the anterior equal to, or shorter than, the posterior; a pair of occipitals; preocular present or absent; ocular moderate or small, eye indistinguishable; rostral *undivided,* grooved anteriorly, separating the nasals, bordering the nostrils; nasals elongate, not reaching the preocular (when present); 3 (*not* 5) upper labials, third largest; mental moderate; postmental large, subcordiform, in contact with the first and second lower labials; 5 chin shields, outer in contact with the second and third lower labials; 195–229 annuli on the body, 17–22 on tail; 16–18 (9–10 + 7–8) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 4 pectorals; 6 anals; 0–0, 1–1, or 2–2 preanal pores.

Dentition. Premaxillary teeth 2–2 or 3–3; maxillaries 3–3 or 4–4; mandibulars 5–5 or 6–6. (Based on recounts kindly furnished by Dr. E. R. Dunn).

Coloration. Above and below, uniformly white except for some plumbeous pigmentation which forms an irregular vertebral line on the posterior two-thirds of the dorsum and tail, while on the latter it extends round in large blotches to the lower surface.

Measurements. Total length 501 (466 + 35) mm.

Distribution. **French Congo:** Fernand Vaz. **French Cameroon:** Sbang (Ssibanga). (Liberia was stated in error). (Known chiefly from the types (A. N. S. P. 9682–4) in the Philadelphia, Berlin and Paris Museums; and the "Ssibanga" example in the Hamburg Museum, which I have examined).

Remarks. Schmidt (1919, p. 603) has drawn attention to the errors in the original description of *galeata;* Mocquard (1903, p. 210) to those of Strauch whose descriptions were based on specimens he had not seen. Dunn informs me that Hallowell's figures were based on A.N.S.P. 9683.

Monopeltis guentheri Boulenger

1885e. *Monopeltis guentheri* Boulenger, Cat. Lizards Brit. Mus., **2**, p. 456, pl. xxiv, fig. 3: Congo.
1895a. Bocage, p. 29.
1897b. Boulenger, p. 277.
1910b. Werner, p. 33.
1917c. Chabanaud, p. 87.
1919g. Boulenger, p. 15.
1927d. Witte, p. 328.
1929c. Witte, p. 8.
1930b. Witte, p. 84.
1933m. Witte, p. 72.
1887c. *Monopeltis Boulengeri* Boettger, Zool. Anz., **10**, p. 649: Kinshasa, near Stanley Pool, Belgian Congo.
1888a. Boettger, p. 24, pl. i, figs. 1a–1d.
1893a. Boettger, p. 78.
1895a. Bocage, p. 29.
1910b. Werner, p. 33.
1922a. Mertens, p. 173.

Description. One or two large shields covering the head, if two then the anterior much shorter than the posterior; a pair of occipitals; a supraocular present or absent; a preocular present (*boulengeri*) or absent (*guentheri*); ocular small, eye indistinguishable; rostral separating the nasals, not or only just bordering the nostrils; nasals elongate, reaching or not reaching the preocular (when present); 3 upper labials, second small, third largest; mental small; postmental large, heptagonal, in contact with the first and second lower labials; 4 chin shields, outer in contact with the second and third lower labials; 246–254 annuli on body, 25–28 on tail; 28–38 (16–22 + 12–16) segments in a midbody annulus, the 2 median ventral segments much broader than long; 4–6 pectorals; 6–8 anals; 3–3 or 4–4 preanal pores.

Dentition. Premaxillary tooth 1; maxillaries 2–2; mandibulars 6–6.

Measurements. Total length 308 (275 + 33) mm.

Distribution. **Belgian Congo:** Kinshasa; Kwamouth; Kwango River; Leverville; Stanley Falls; Stanleyville; Temvo near Mayumbe.

French Congo: Brazzaville near Stanley Pool. (The five cotypes of *guentheri* were originally in the British Museum, the holotype of *boulengeri* in the Senckenberg Museum, Frankfort a. Main).

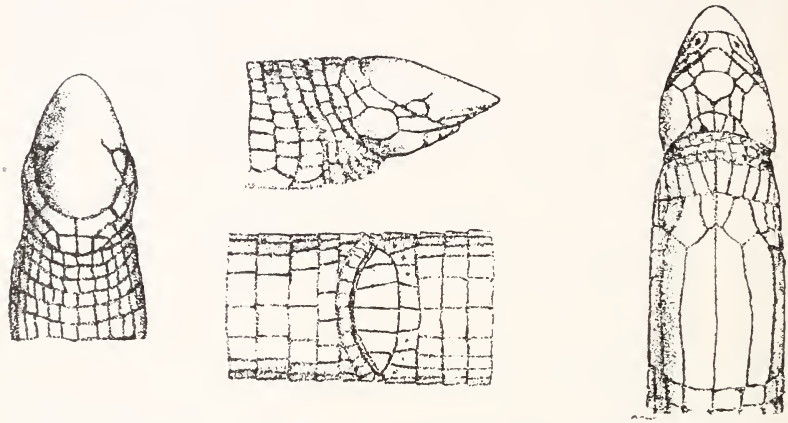

Fig. 40. *Monopeltis guentheri* (Type after Boulenger).

Remarks. The unique type of *M. boulengeri* came from the same general region as numerous examples of *guentheri*. It was differentiated by the presence of a preocular (the scale called by that name in Boulenger's description of *guentheri* is elsewhere called an ocular) the location of which was indicated by a suture in the figured type of *guentheri*. In an example (M.C.Z. 18015) received from the Paris Museum, labeled 'Congo', the right side of the head is *boulengeri*, the left *guentheri*. The annuli in the types of both species were the same, but there were 38 (instead of 28–32) segments in a midbody annulus of *boulengeri*. At Stanley Falls specimens occur with both one or two shields covering the head.

Monopeltis schoutedeni Witte

1933c. *Monopeltis Schoutedeni* Witte, Revue Zool. Bot. Afr., **23**, p. 170, fig. 2: Kunungu, Lake Leopold II, Belgian Congo.

1933m. Witte, p. 73, figs. 1–4.

Description. One large shield covering the head; a pair of occipitals; a preocular; ocular small, eye indistinguishable; rostral separating the nasals, bordering the nostrils; nasals elongate, apparently not reaching

the ocular; 3 upper labials, second longest, third highest; mental small; postmental large, heptagonal, in contact with the first and second lower labials; 4 chin shields, outer in contact with the second and third lower labials; 276 annuli on body, 29 on tail; 32 (18 + 14) segments in a midbody annulus, the 2 median ventral segments two and a half times as broad as long; 6 pectorals; 8 anals; 5–5 preanal pores.

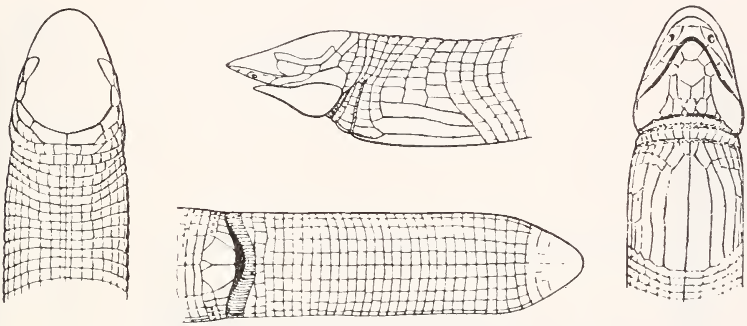

Fig. 41. *Monopeltis schoutedeni* (Type after Witte).

Measurements. Total length 350 (311 + 39) mm.

Distribution. **Belgian Congo:** Lake Leopold II: Kunungu. (Known only from the type in the Congo Museum, Tervueren).

Remarks. Though very closely related to *guentheri,* which also has been recorded from Lake Leopold II by Witte, it seems advisable to recognize *schoutedeni* for the present on the basis of its aggregate higher counts of annuli on body and tail, anals and pores, though none of these taken alone might be expected to be beyond the probable range of *guentheri.* The difference in pores is bridged by M.C.Z. 18015 with 4–4. The difference in appearance of the preocular is not considered of importance.

Monopeltis lujae Witte

1922a. *Monopeltis Lujae* Witte, Revue Zool. Afr., **10**, p. 67, pl. i, fig. 2: Lubué, Kasai district, Belgian Congo.

Description. One large shield covering the head; a pair of occipitals; a preocular; ocular small, eye indistinguishable; rostral separating the nasals, bordering the nostrils; nasals elongate, reaching the preocular; 3 upper labials, third largest; mental small; postmental large, penta-

gonal, in contact with the first and second lower labials; 4 chin shields, outer in contact with the second and third lower labials; 227 annuli on body, 19 on tail; 30–32 (20 + 10–12) segments in a midbody annulus, anteriorly the median ventral segments tend to fuse into transverse bands recalling the ventral shields of snakes; 6 pectorals; 4 anals; 0–0 preanal pores.

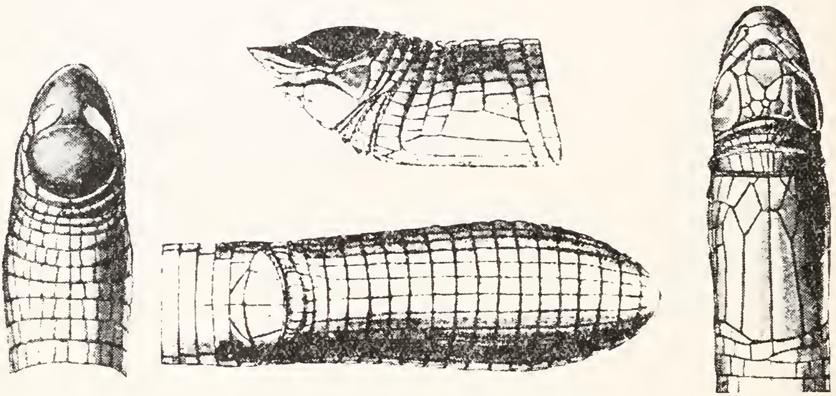

Fig. 42. *Monopeltis lujae* (Type after Witte).

Measurements. Total length 350 (322 + 28) mm.

Distribution. **Belgian Congo:** Kasai district: Lubué. (Known only from the type in the Congo Museum, Tervueren).

Remarks. In view of the fact that in *M. guentheri* we find that either a single or pair of shields may be present on the head, it appears highly probable that *lujae* will prove to be synonymous with *vanderysti* which, however, retains two large head shields still unfused, and which possesses a loreal unfused with head shield or preocular. Good series of both species from their type localities are badly needed to settle this point.

Monopeltis capensis gazei FitzSimons

1937b. *Monopeltis capensis gazei* FitzSimons, Ann. Transvaal Mus., **17**, p. 278, figs. 10–12: Junction of Magalakwin and Limpopo Rivers, Zoutpansberg district, Transvaal.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral separating the

nasals, not bordering the nostrils; nasals elongate; 3 upper labials, third largest; mental moderate; postmental moderate, pentagonal, in contact with the first lower labial; 2 chin shields, in contact with all 3

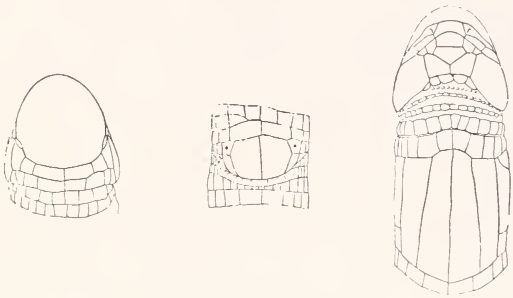

Fig. 43. *Monopeltis capensis gazei* (Type after FitzSimons).

lower labials; 239–264 annuli on body, 10–11 on tail; 52–54 (32 + 20–22) segments in a midbody annulus, the 2 median ventral segments almost two times as broad as long; 4–6 pectorals; 4 anals; 1–1 preanal pores.

Measurements. Total length 286 (272.8 + 13.2) mm.

Distribution. **Transvaal:** Zoutpansberg district: Magalakwin and Nwanedzi Rivers. (Known only from the type (T. M. 13342) and paratype (T. M. 3477) in the Transvaal Museum).

Monopeltis capensis capensis Smith

1848. *Monopeltis capensis* A. Smith, Ill. Zool. S. Africa, Rept., pl. lxvii: 24° south latitude, South Africa.
1867b. Peters, p. 235.
1869b. Peters, p. 661.
1873b. Bocage, p. 216.
1882. Peters, p. 89.
1885e. Boulenger, p. 455, pl. xxiv, figs. 1a–1d.
1895a. Bocage, p. 28.
1898. Sclater, p. 104.
1910b. Boulenger, p. 472.
1910a. Hewitt, pp. 60, 69.
1910a. Werner, p. 328.
1910b. Werner, p. 33.
1911b. Sternfeld, p. 403.

1911d. Sternfeld, p. 26, figs. 25–26.
1913. Hewitt & Power, p. 155.
1914a. Nieden (1913), p. 450.
1915c. Werner, p. 340.
1925b. Flower, p. 949.
1936c. Parker, p. 140.
1937a. FitzSimons, p. 267.
1937b. Monard, p. 65.
1865. *Monotrophis capensis* Gray, p. 454.
1872. Gray, p. 41.
1873. Gray, p. 118.
1881. *Lepidosternon capense* Strauch, p. 462.

Description. One or two (see *Remarks*) large shields covering the head; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral separating the nasals, not bordering the nostrils; nasals elongate, not reaching the ocular; 3 upper labials, third largest;

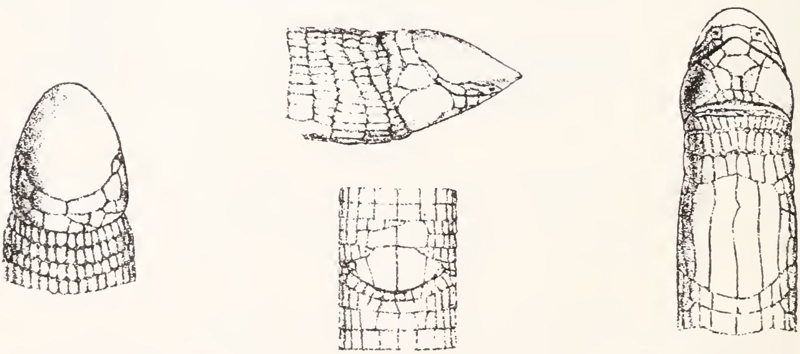

Fig. 44. *Monopeltis capensis capensis* (Type after Boulenger).

mental moderate; postmental large, pentagonal, in contact with the anterior lower labials; 2, 3 or 4 chin shields, outer in contact with all 3 lower labials though barely with the anterior; 194–230 annuli on body, 8–12 on tail; 42–56 (40 *fide* Werner) (22–28 + 20–28) segments in a midbody annulus, the 2 median ventral segments slightly broader than long; 4–6 pectorals; 4–6 anals; 0–0 or 1–1 preanal pores.

Dentition. Premaxillary tooth 1; maxillaries 2–2 (Parker) or 3–3; mandibulars 7–7.

Measurements. Total length 350 (330 + 20) mm.

Longevity. 1 year, 10 months, 27 days. (Flower).

Habitat. The Humbe series were taken at a depth of from 15 to 20 centimetres.

Distribution. **Transvaal:** Klipvil Farm; Nylstroom; Vygeboompoort. **Cape Province:** Fort Richmond; Kimberly; Little Namaqualand. **South West Africa:** Aub to Klein Nauas; Gobabis; Grootfontein; Naumtoni to Outgo; Okahandja; Otjimbingue; Omatjenne; Ombujomatemba; Rehoboth; Windhuk. **Angola:** Humbe, Kunene River.

Müller's (1885d, p. 701) record from Gaboon is referred to *jugularis*. Peters' (1854, p. 620) became the type of *sphenorhynchus*.

Remarks. A series of eight amphisbaenids from Ombujomatemba, near Waterberg, received from Herr. W. Hoesch since this paper was written, prove to be of exceptional taxonomic interest. The three juveniles (M.C.Z. 43152–4), 106 to 120 mm. in length, agree with *vernayi* and *anchietae* in possessing two large shields on the head, in addition, though a point of no consequence, no preanal pores are distinguishable. Otherwise they entirely agree with the single-shielded adults, ranging from 205 to 276 mm. in length, with whom they are undoubtedly specifically identical. The variation displayed by these eight lizards is: 3–4 chin shields; 194–206 annuli on body, 10–11 on tail; 49–56 segments in a midbody annulus; 4–6 pectorals; 0–1 preanal pores.

As *M. anchietae* occurs at Waterberg (M.C.Z. 39907–9), does this material imply that hybrids between *anchietae* and *capensis* occur? A comparison of the two ranges as given under 'Distribution' shows them to be contiguous and not infrequently both species have been recorded from the same or adjacent localities, *capensis* alone, however, has been taken in the Transvaal. Further examination of the data reveals that 36 and 38 midbody segments are as rare for *anchietae* as are 52, 54 or 56 for *capensis*.

It does not mean that juveniles have always two cephalic shields for young *capensis* are frequently quite typical in possessing a single shield. It does appear as if we are dealing with a single species though at the present stage I do not contemplate taking so drastic a step. *M. vernayi* occupies an intermediate position between the two types and is almost certain to be synonymized with one or the other. If the ranges of all three are united, they would read: 40–50 (rarely 36–56) segments in a midbody annulus; 182–230 annuli on body, 8–12 on tail; 0–0 or 1–1 preanal pores.

MONOPELTIS HABENICHTI FitzSimons

1937b. *Monopeltis habenichti* FitzSimons, Ann. Transvaal Mus., **17**, p. 276, figs. 3–5: Lourenço Marques, Mozambique.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral separating the nasals, not bordering the nostrils, separated from anterior labial

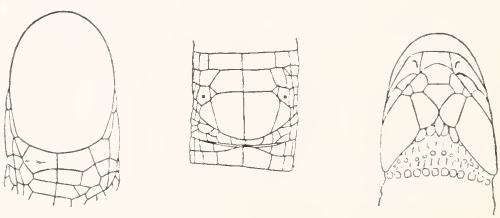

Fig. 45. *Monopeltis habenichti* (Type after FitzSimons).

by lower portion of nasal; nasals elongate; 3 upper labials, third largest; mental moderate; postmental moderate, pentagonal, in contact with anterior lower labial; 2 chin shields, in contact with all 3 lower labials; 271–273 annuli on body, 9–11 on tail; 42–44 (24-26 + 18) segments in a midbody annulus, the 2 median ventral segments once and two-third times as broad as long; 4–6 pectorals; 4 anals; 1–1 preanal pores.

Measurements. Total length 245 (236.5 + 8.5) mm.

Distribution. **Mozambique:** Lourenço Marques. (Known only from the type (T. M. 3400) and three paratypes (T. M. 3323, 3401–2) in the Transvaal Museum).

MONOPELTIS DECOSTERI Boulenger

1910b. *Monopeltis decosteri* Boulenger, Ann. S. African Mus., **5**, pp. 472, 495: Delagoa Bay, Mozambique.

1937b. V. FitzSimons, p. 277, figs. 6–9.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral separating the nasals, not bordering the nostrils; nasals elongate, not reaching the ocular; 3 upper labials, third largest; mental moderate; postmental large, pentagonal, in contact with the first and second lower labials;

2 chin shields, in contact with third lower labial; 193 annuli on body, 11 on tail; 34 (20 + 14) segments in a midbody annulus, the 2 median ventral segments slightly more than two times as broad as long; 4 pectorals; 2 anals; 1–1 preanal pores.

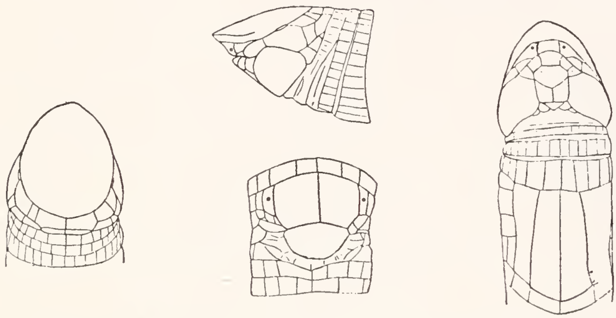

Fig. 46. *Monopeltis decosteri* (Type after FitzSimons).

Measurements. Total length 215 (205 + 10) mm.

Distribution. **Mozambique:** Delagoa Bay. (Known only from the type (S. A. M. 650) in the South African Museum).

Remarks. Differs only from *sphenorhynchus* in possessing the normal number of 3 lower labials.

Monopeltis sphenorhynchus Peters

1854. *Monopeltis capensis* (not of Smith) Peters, Ber. Akad. Wiss. Berlin, p. 620.
1855. Peters, p. 49.
1879b. *Monopeltis sphenorhynchus* Peters, Monatsb. Akad. Wiss. Berlin, p. 275: Inhambane, Mozambique (now restricted).
1882. Peters, p. 87, pl. xiiiA, figs. 1–3.
1885e. Boulenger, p. 455.
1891a. Boulenger, p. 306.
1896a. Bocage, p. 99.
1910a. Hewitt, pp. 60, 70.
1910b. Werner, p. 33.
1881. *Lepidosternon sphenorhynchus* Strauch, p. 465.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral separating the nasals, not bordering the nostrils; nasals elongate, not reaching the ocular; 3 upper labials, third largest; mental moderate; postmental

large, pentagonal, in contact with anterior lower labials; 2–3 chin shields, outer in contact with *both* lower labials; 198–204 (see Remarks below) annuli on body, 11–12 on tail; 32–34 (18–20 + 14) segments in a midbody annulus, the 2 median ventral segments much broader than long; 4–6 pectorals; 4 anals; 1–1 preanal pores.

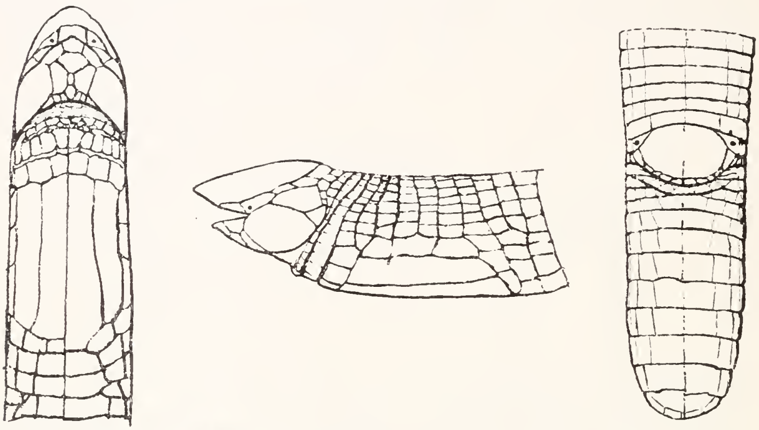

Fig. 47. *Monopeltis sphenorhynchus* (Type after Peters).

Dentition. Premaxillary 1; maxillaries 2–2; mandibulars 7–7 (?).

Measurements. Total length 258 (245 + 13) mm.

Distribution. **Mozambique:** Inhambane. **Nyasaland:** Shire Valley. (See Remarks below).

Remarks. Peters (1882, p. 88) mentions Angola in the text but omits it from the Habitat, as does Boulenger (1885e, p. 455). This together with the mention of 252 annuli on body suggests a misprint or some continued confusion with *capensis*.

The fact that this is the only species in the genus which is recorded as having only 2 lower labials, raises the question as to whether the few known examples of *sphenorhynchus* are not aberrant. Should this prove to be the case and the number of labials are inconstant, then it seems probable that *decosteri* would become a synonym.

Genus Dalophia

1865. *Dalophia* Günther, Proc. Zool. Soc. London, p. 454 (type *welwitschii*).

No preanal pores; tail cylindrical, abruptly truncate, ending in a callose pad. Otherwise characters as in *Monopeltis* with which genus it

was united by Boulenger (1885e, p. 454) when only the type species was known. Its members, however, form a natural group.

Coloration. With the exception of *longicauda*, the coloration of all species in the genus is uniformly flesh pink in life, colorless in alcohol. Under these circumstances it has not been considered necessary to repeat it for each species.

Range. Tropical and northern South Africa.

Synopsis of the Species

I. One or two large shields covering the head.

38–39 segments in the midbody annulus; 314–334 annuli on body, 23–24 on tail . . . . *gigantea* (p. 429)

II. One large shield covering the head.

34 segments in a midbody annulus; 271–275 annuli on body, 22–23 on tail . . . . *welwitschii* (p. 431)

30–32 segments in a midbody annulus; 320 annuli on body, 38 on tail . . . . *longicauda* (p. 432)

30 segments in a midbody annulus; 320–330 annuli on body, 43–45 on tail . . . . *ellenbergeri* (p. 433)

36 segments in a midbody annulus;[1] 223 annuli on body, 32 on tail . . *jallae* (p. 433)

28–34 segments in a midbody annulus; 290–328 annuli on body, 24–29 on tail . . . . *pistillum* (p. 434)

DALOPHIA GIGANTEA (Peracca)

1903. *Monopeltis giganteus* Peracca, Boll. Mus. Zool. Torino, **18**, No. 448, p. 1, fig. –: Congo.

1910b. Werner, p. 34.

1922a. *Monopeltis truncata* Witte, Revue Zool. Afr., **10**, p. 68, pl. i, figs. 3–3c: Kwango district, Belgian Congo.

1927c. Witte, p. 104.

Description. One or two large shields covering the head, if two then the anterior shorter than the posterior; 2 pairs of occipitals; a preocular present or indicated; ocular small, eye distinguishable or indis-

[1] Professor O. Arcangeli informs me (1.ix.37) that the type cannot be located, but agrees that this number is almost certainly a misprint for 323. When the type is found and the description checked, it is possible that *jallae* may become a synonym of *pistillum*.

tinguishable; rostral elongate, not separating the nasals, bordering the nostrils; nasals elongate, extending upwards to the preocular; 3 upper labials, second longest, third highest; mental small, subquadrangular;

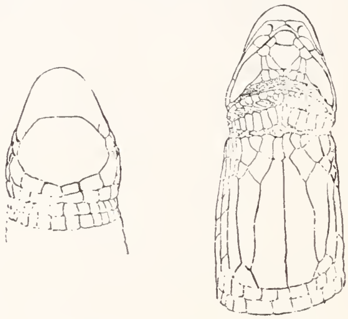

Fig. 48. *Dalophia gigantea* (Type after Peracca).

postmental large, pentagonal or heptagonal, almost or completely separating the inner pair of chin shields; 4 chin shields, outer in contact with the second and third lower labials; 314–334 annuli on body,

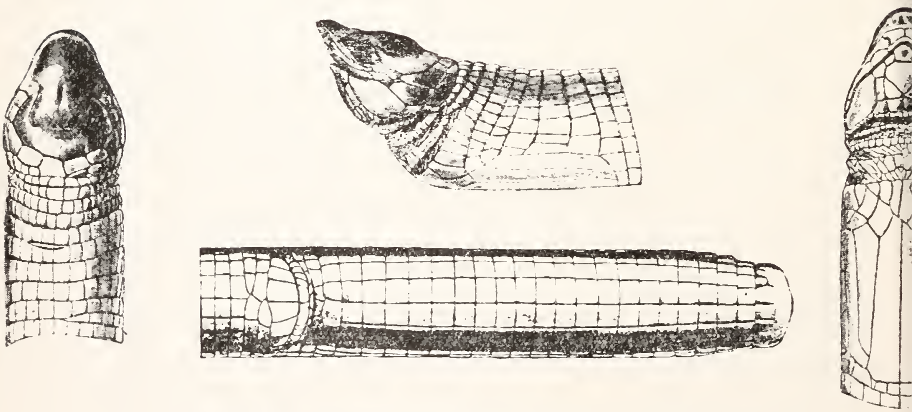

Fig. 49. *Dalophia gigantea* (Type of *truncata* after Witte).

23–24 on tail; 38–39 (20–21 + 18) segments in a midbody annulus, the 2 median ventral segments broader than long; 6 pectorals; 5–6 anals; 0–0 preanal pores.

Measurements. Total length of type of *gigantea* 650 (592 + 58) mm., of type of *truncata* 650 (590 + 60) mm.

Distribution. **Belgian Congo:** Kwango district; Popokabaka (Known only from the two cotypes of *gigantea* in the Turin Museum, and the type and second example of *truncata* in the Congo Museum, Tervueren).

Remarks. As has been shown in the case of *Monopeltis guentheri* and *M. c. capensis*, individuals of both these species with either a single or with two shields covering the head occur. As the types of both *gigantea* (two shields) and *truncata* (one shield) differ in no other important character it seems logical to unite them. Their essential data is as follows:

38–39 segments in a midbody annulus; 314–325 annuli on body, 23 on tail.... *gigantea*

38 segments in a midbody annulus; 334 annuli on body, 24 on tail. .*truncata*

DALOPHIA WELWITSCHII Gray

1865. *Dalophia welwitschii* Gray, Proc. Zool. Soc. London, p, 454, figs. 7–8: Pungo Andongo, Angola.
1872. Gray, p. 41.
1872. Gray, p. 118.
1879. Peters, p. 276, footnote.
1885e. *Monopeltis welwitschii* Boulenger, Cat. Lizards Brit. Mus., **2**, p. 456, pl. xxiv, fig. 2.
1895a. Bocage, p. 29.
1902a. Werner, p. 342.
1910b. Werner, p. 33.
1931b. Witte, p. 41.
1937b. Monard, p. 65.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye indistinguishable; rostral small, triangular, separating the nasals, not bordering the nostrils; nasals elongate; 3 upper labials, third highest; mental moderate, quadrangular; postmental large, pentagonal, not separating the inner pair of chin shields; 4 chin shields, outer in contact with second and third lower labials; 271–275 annuli on body, 22–23 on tail; 34 (20 + 14) segments in a midbody annulus, the 2 median ventral segments much broader than long; 6 pectorals; 6 anals; 0–0 preanal pores.

Measurements. Total length 289 (265 + 24) mm.

Habitat. In a humid and muddy locality at Leverville.

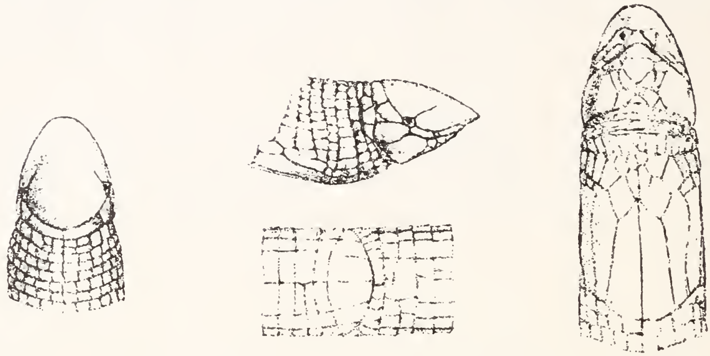

Fig. 50. *Dalophia welwitschii* (Type after Boulenger).

Distribution. **Angola:** Pungo Andongo. **Belgian Congo:** Kwango district: Leverville. Lower Congo. (Known only from the cotypes in the British Museum, and four other specimens).

Dalophia longicauda (Werner)

1915. *Monopeltis longicauda* Werner, Rept. Amph., in Michaelsen, Beitr. Kennt. Land- Susswass. Deut.-Südwestafrikas, **3**, p. 340: Okavango River, South West Africa.

Description. (Top of head missing); mental moderate, subquadrangular; postmental large, subpentagonal, not separating the chin shields; 6 chin shields, outer in contact with the second and third lower labials; 320 (not 330) annuli on body, 38 (not 37) on tail; 30–32 (18 + 12–14) segments in a midbody annulus, the 2 median ventral segments two times as broad as long; 6 pectorals; 5 anals; 0–0 preanal pores.

Coloration. As in other members of the genus but when examined with a lens, the centre of each segment on the dorsal surface of the tail is seen to be a glossy enamel-like white.

Measurements. Total length 299 (247 + 52) mm.

Distribution. **South West Africa:** Okavanga River forming northern boundary. (Known only from the mutilated type (No. 4275) in the Hamburg Museum).

Remarks. Through the courtesy of the Director of the Hamburg Museum and Herr. de Grys, I have been able to reëxamine the type and write the above description involving several alterations from the original, including measurements.

If *ellenbergeri* can be maintained distinct on the sole basis of more numerous caudal annuli, it is at most an eastern race of *longicauda.*

DALOPHIA ELLENBERGERI (Angel)

1920b. *Monopeltis Ellenbergeri* Angel, Bull. Mus. Hist. Nat. Paris, **26**, p. 615, figs. 1–2: Lealui, Upper Zambesi, Northern Rhodesia.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye distinguishable; rostral small, triangular, not separating the nasals, not bordering the nostrils; nasals elongate, extending upwards to the ocular; 3 upper labials, second longest, third highest; mental moderate, subquadrangular; postmental large, pentagonal, not separating the inner pair of chin shields; 4 chin shields, outer in contact with the second and third lower

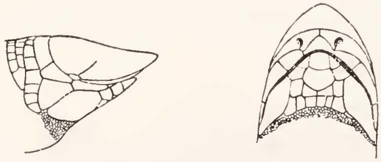

Fig. 51. *Dalophia ellenbergeri* (Type after Angel).

labials; 320–330 annuli on body, 43–45 on tail; 30 (18 + 12) segments in a midbody annulus, the 2 median ventral segments broader than long; 6 pectorals; 6 anals; 0–0 preanal pores.

Dentition. Premaxillary tooth 1; maxillaries 1–1; mandibulars ?.

Measurements. Total length 430 (350 + 80) mm.

Distribution. **Northern Rhodesia:** Lealui (Lialui), Upper Zambesi. (Known only from the three cotypes (P. M. 1920: 78–80) in the Paris Museum, Monard's (1931, p. 97) Kakindo material being referred to *pistillum*).

DALOPHIA JALLAE (Peracca)

1910. *Monopeltis jallae* Peracca, Boll. Mus. Zool. Torino, **25**, No. 624, p. 1, fig. —: Barotseland, Upper Zambesi, Northern Rhodesia.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye distinguishable; rostral small, triangular, not quite separating the nasals; 3 upper labials, second longest, third highest; mental moderate, subquadrangular; postmental large, pentagonal; [1]223 annuli on body, 32 on tail; 36 (22 + 14) segments in a midbody annulus, the 2 median ventral segments broader than long; 6 pectorals; 6 anals; 0–0 preanal pores.

Measurements. Total length 530 (460 + 70) mm.

Distribution. **Northern Rhodesia:** Barotseland, Upper Zambesi. (Known only from the type in the Turin Museum).

Remarks. Differs only from *pistillum* in the number of annuli on body and tail, if, as I suspect, these are erroneous, it would become a synonym of that species. In this connection it may be pointed out that both the types of *jallae* and *colobura* (a syn. of *pistillum*) were taken by the same missionary, the Rev. L. Jalla.

Dalophia pistillum (Boettger)

1895. *Monopeltis pistillum* Boettger, Zool. Anz., **18**, p. 62: Zambesi.
1910b. Werner, p. 33.
1922a. Mertens, p. 173.
1907j. *Monopeltis granti* Boulenger, Proc. Zool. Soc. London, p. 485, fig. 141: Beira, Mozambique.
1910b. Boulenger, p. 473.
1910a. Hewitt, p. 60.
1910b. Werner, p. 33.
1910b. *Monopeltis colobura* Boulenger, Ann. S. African Mus., **5**, pp. 473, 495: Sesheke, Barotseland, Northern Rhodesia.
1914a. Nieden (1913), p. 450.
1915c. Werner, p. 340.
1920b. Angel, p. 615.
1920a. Loveridge, p. 145.
1934. Pitman, p. 304.
1933. *Monopeltis granti transvaalensis* FitzSimons, Ann. Transvaal Mus., **15**, p. 277, figs. 3–5: Hope, between Nylstroom and Vaalwater, Waterberg district, Transvaal.
1937b. Monard, pp. 65, 67.
1934a. *Monopeltis mossambica* Cott, Proc. Zool. Soc. London, p. 155, figs. la-le: Caia, Mozambique.
1931. *Monopeltis ellenbergeri* Monard (not of Angel), p. 97.
1937b. *Monopeltis granti kuanyamarum* Monard, Arqu. Museu Bocage, **8**, pp. 65, 67: Mupanda, Angola.

[1] Almost certainly a misprint for 323, see footnote to genus.

Description. One large shield covering the head; a pair of occipitals; no preocular; ocular small, eye distinguishable; rostral small, tri-

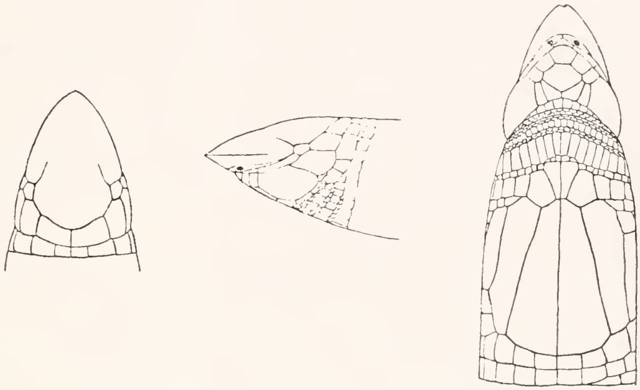

Fig. 52. *Dalophia pistillum* (Type of *granti* after Boulenger).

angular or subtriangular, not quite separating the nasals, not bordering the nostrils; nasals elongate, extending upwards to the ocular; 3 upper labials, second longest, third highest; mental moderate, sub-

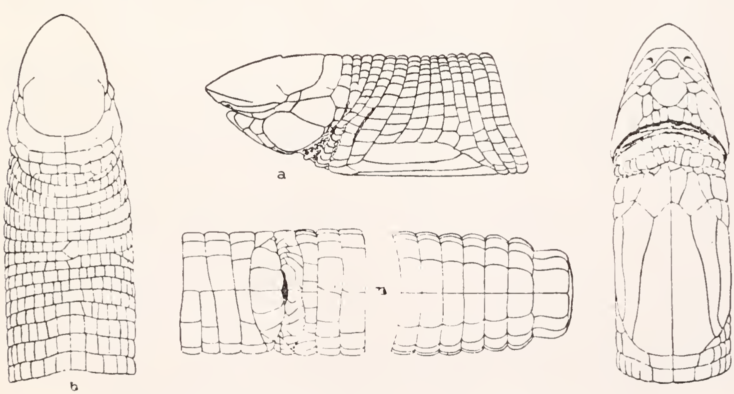

Fig. 53. *Dalophia pistillum* (Type of *mossambica* after Cott).

quadrangular or pentagonal; postmental large, heptagonal, not separating the inner pair of chin shields; 4 chin shields, not in contact with the second and third lower labials; 276–328 (276–299 in *mossambica*,

290–320 in *colobura*, 308 in *kuanyamarum*, 328 in *transvaalensis*) annuli on body, 24–29 (24–27 in *pistillum*, 25–26 in *kuanyamarum*, 25–28 in *colobura*, 29 in *transvaalensis*) on tail; 28–34 (18–20 + 10–14) segments in a midbody annulus, the 2 median ventral segments more than once and a half times as broad as long; 6 pectorals; 4–6 anals; 0–0 preanal pores.

Measurements. Total length 520 (477 + 43) mm.

Breeding. Two females, taken at Lumbo at end of August, each held four eggs, measuring 35 x 9 mm. and 35 x 10 mm. respectively. On September 20, a third specimen laid four eggs which measured 26 x 9, 30 x 9, 32 x 8 and 35 x 8 mm.

Enemies. At Lumbo on September 1, 2.15 p.m., with the sun beating fiercely, I found one of these lizards wriggling on the scorching sand, except for the last few inches which were still buried in the sand. On withdrawing these I found both tail and anal region smothered in driver ants (*Dorylus helvolus*), a fierce species which, however, detests light.

At 3 p.m. on September 20, under similar conditions, another amphisbaenid was found wriggling over the sand with a few ants tenaciously biting at its tail and a trail of them left to mark its course. Next morning a third specimen was brought to me. It was suffering from a severe haemorrhage in the intestinal region to which it succumbed during the day. Apparently it represented a third stage of victimization by these voracious ants.

Distribution. **Mozambique:** Beira; Caia; Lumbo. **Northern Rhodesia:** Barotseland: Sesheke; Lealui (Lialui) on Upper Zambesi River. **Transvaal:** Waterberg district: Hope. **South West Africa:** Grootfontein (*fide* Nieden). **Angola:** Kakindo (Caquindo); Kuvangu: Mupanda.

Remarks. I had already referred Monard's record of *ellenbergeri* to the synonymy of *pistillum* before his later paper (1937b, p. 67)reached me. In this paper he amends the identification to *transvaalensis*, itself a synonym of *pistillum* in my opinion. When adequate series are available eastern and western forms may prove to be recognizable though no signs of this appear from present records.

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THE ANTENNAE OF LEPIDOPTEROUS LARVAE

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INTRODUCTION

Anatomical studies of larval insects while frequently laying much emphasis on the mouthparts seldom treat the antennae at any length. This is particularly true in the case of the Lepidoptera. Though the antennae have been studied in isolated cases, no general study of the order has been attempted up to this time.

It is the purpose of this paper to present the results of a detailed investigation of the antennae of thirty-eight families of Lepidoptera. Over two thousand specimens representing some one hundred and eighty species were examined. It is felt that certain features of the external structure as yet found nowhere else in insects together with remarkable histological structures most easily observed in the antennae justify a lengthy treatment. Also it was possible to arrive at various taxonomic and evolutionary conclusions only through intensive study of many species.

The function of the larval antennae is not discussed here. There is ample reason to believe that the antennae bear tactile and chemoreceptors (Dethier, 1937) though continued investigation on this phase of the subject is desirable.

Acknowledgements

To Professor C. T. Brues, under whom this investigation was conducted, I gratefully acknowledge my indebtedness. It was through the kindness of Professor Thomas Barbour and Professor Nathan Banks

that the collections of the Museum of Comparative Zoölogy were placed at my disposal. This study is based primarily on the Museum collections. Professor F. M. Carpenter has been especially generous in making available specimens of Megaloptera, Raphidiodea, Neuroptera, and Mecoptera. Finally I wish to acknowledge the kindness of Dr. Gaines Liu who translated both Chinese and Japanese papers.

HISTORICAL

There has been no thorough study of the antennae of lepidopterous larvae although in a few isolated cases they have been investigated in more or less detail. Among the older writers Lyonet (1760) was the only one who described the antennae with any amount of detail or accuracy (*Cossus ligniperda* Fabr.). Although he did not depict the sense organs on the distal end, he did illustrate the musculature and the innervation in his excellent drawings. He also noted that the antennae could be retracted. Dimmock (1874) included the antennae in his figures of the heads of *Gracilaria syringella* Fabr. in the early and later instars. In a similar manner the antennae of *Lithocolletis cincinnatiella* Cham. were figured by Chambers (1877). Packard (1884) with slightly more detail figured the antennae of *Nymphula formosalis* Clem. Blanc (1889) studied the internal and external anatomy as well as the histology of the antennae of *Bombyx mori* L. Hart (1892–1897) briefly recorded the form of the antennae of *Nymphula obscuralis* Grt. and *N. obliteralis* Wlk. Nägel (1892) examined the antennae of *Antherea pernyi* Guerin., *Orgyia gonostigma* Fabr., *Mamestra pisi* L., *Saturnia carpini* Schiff., and *Macroglossa stellatarum* L. He not only described the sense organs and their innervation very carefully but figured the distal end of the antenna of *M. pisi* with great accuracy. Chapman (1894) presented a rather detailed account of the antennae of *Eriocephala calthella* L. Packard (1895) figured the antennae of the same species while Hofmann (1899) mentioned them in his text. The next detailed account following that of Nägel was Dampf's (1910) very detailed description of the antennae of *Eumeta* sp., *Talaeporia tubulosa, Adela degeerella* L., *Tineola biselliella* Hüm., and *Solenobia triquetrella* F. v R. Forbes (1910) described and figured the antennae of *Nymphula maculalis* Clem. in some detail. In another paper (1910a) he figured the antennae of *Malacosoma disstria* Hbn., *Lagoa crispata* Pack., *Cacoecia cerasivorana* Fitch, *Diacrisia virginica* Fabr., "*Simaëthis oxyacantha*", and "*Yponomeuta cagnagellus*". The account by Trägardh (1913) of the antennae of leaf-miners is very

accurately detailed. Also admirably detailed are the figures and descriptions of Busck and Böving (1914) of *Mnemonica auricyanea* Wlshm. Heinrich and DeGryse (1915) presented a similar account of *Acrocercops strigifinitella* Clem. McIndoo (1919) studied the innervation of the antennae of *Phlegethontius quinquemaculata* Haw. Grandi (1922 and 1923) compared the antennae of the various instars of *Bombyx mori* L. Tillyard (1922) described the antennae of *Sabatinca barbarica* Philp. The antenna of a phalaenid, *Leucania unipuncta* Haw., was carefully worked out anatomically by Ripley (1923). Snodgrass (1928) described the gross anatomy and musculature of the antennae of several species. Lopez (1929) figured the sense organs on the antennae of *Carpocapsa pomonella* L. Henig (1931) studied the innervation of the antenna and its sense organs (*Orthosia lota* Clerck.). Tanaka and Hino (1931) investigated the variation in the sense organs on the antennae of *B. mori.*

ANATOMY

The antennae of lepidopterous larvae are remarkable for the uniformity which they present throughout the order as contrasted with the larvae of other orders (cf. pp. 494–501). They are located on the ventral lateral surface of the head, arising from the region of the postgenae near the bases of the mandibles. They are inserted into a membranous area in the head capsule known as the antacoria (antennal socket (Snodgrass)) (Fig. 3). Concerning the number of segments which make up the antenna there has been a diversity of opinion. There is apparently no criterion for determining just what constitutes a segment in these antennae. There are eight possible ways in which the segmentation may be logically interpreted. Beginning with the antacoria and proceeding distally there may be from two to five segments (Fig. 1; a, b, c, and d). By this method the least logical deduction is a two-segmented antenna. To my knowledge no one advocates this enumeration. Three segments have been recognized by Peterson (1912), Henig (1931), and Dethier (1937); four by Scudder (1889) and Packard (1895). No one has attempted to list five segments. Beginning with the first segment distal to the antacoria and proceeding distally one may count from two to four segments (Fig. 1; e, f, and g). McIndoo (1919) preferred to recognize two. Three were recognized by Blanc (1889), Dampf (1910), Trägardh (1913), Busck and Böving (1914), Heinrich and DeGryse (1915), Grandi (1922), Tillyard (1922), and Snodgrass (1928). Trägardh went further in

that he regarded the base of the sensillum styloconicum (Fig. 4) as a lobe or continuation of segment three. Four segments were enumerated by Forbes (1910a) and Ripley (1923). Finally the segmentation may be interpreted as beginning with the second segment distal to the antacoria (Fig. 1; h). This method has been tentatively suggested by Busck and Böving and adopted by Lopez (1929). Berlese (1901) figured the antennae without numbering the segments.

After having studied many forms it seems best to accept the segmentation adopted by the majority of authors for several reasons. First, as has been pointed out by other workers, the antacoria is obviously not a segment. It appears to me to be homologous with the antacoriae of the larval antennae of other orders (cf. Gage, 1920; Yuasa, 1922; Steiner, 1930). As will be seen the musculature corroborates this conception. Second, the third segment under this system of numbering possesses all the attributes of a segment as we arbitrarily understand it. Moreover, convenience favors this procedure. Third, a study of the modifications of the sensillum styloconicum throughout the order (e.g. Figs. 13, 17, 34, 42, 45, and 79) convinces me that it cannot be regarded as a segment.

Segment one (Fig. 4) is usually shorter than segment two, rarely equal to it in length, and in a very small number of cases longer. In exceptional cases it is partially or entirely lacking. In many species it contains four sensilla companiformia arranged more or less in a line at right angles to the axis of the antenna (Fig. 82). Oftentimes there is great difficulty in locating these sensilla and undoubtedly they are absent in many forms. The second segment is nearly always the longest of the three. Frequently it has a greater diameter at the distal than at the proximal end; but in all species examined, with the exception of some of the leaf-miners, it is longer than wide. Upon it occur most of the sensilla of the antenna. At the proximal end, approximately in line with the longer hair, there is located a single sensillum campaniformium. Due to an error in terminology this was previously referred to as a sensillum placodeum. Its position along the axis varies considerably. Next in order are two long thick-walled hairs (sensilla trichodea) which are always present (cf. leaf-miners). These are true hairs arising from articulation sockets. Their absolute and relative lengths are subject to considerable variation. In addition to these and proximal to them there may be a number of other sensilla trichodea in some species (e. g. *Danaus plexippus* L.) (Figs. 20, 26, 30, 116, and 148). Distally there are always three sensilla basiconica (in some species there may be an additional one which is very minute, also the smallest

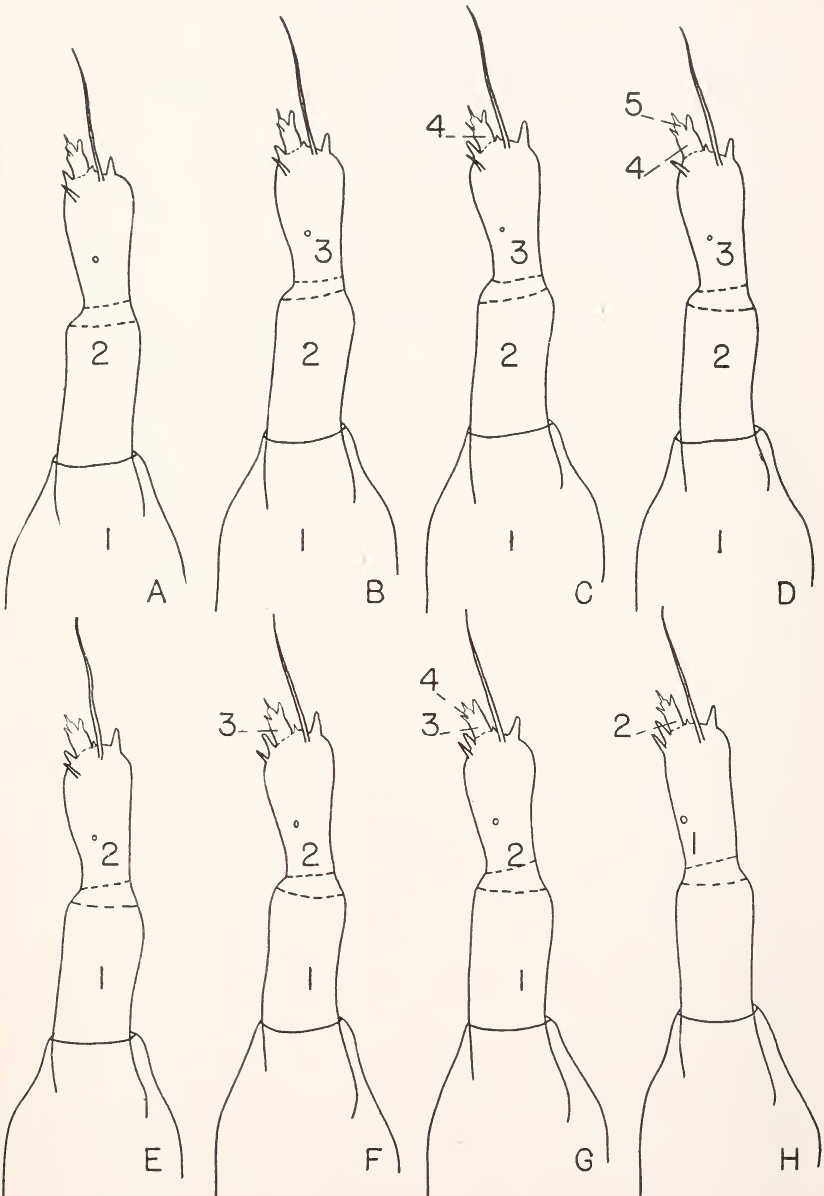

Fig. 1. Eight possible interpretations of the segmentation of the larval lepidopterous antenna. Explanation in text.

of the three may resemble a sensillum trichodeum). Segment three assumes the form of a small headpiece which arises apically but off-center or eccentrically from the second segment. It is usually barrel-shaped but may be either long and thin, that is, notably longer than wide, reduced to a squat structure barely elevated above the general surface of segment two (Fig. 58), or entirely wanting (Fig. 125). Under ordinary circumstances it contains four sensilla apically (Fig. 4). Present in the majority of cases is the sensillum styloconicum which some workers prefer to designate as another segment. A large sensillum basiconicum appears in all species which retain the third segment. The two remaining sensilla basiconica may be either blunt or acute cones; one is often reduced to an almost imperceptible projection of the surrounding surface. At times even the most painstaking examination of numerous specimens of a species has failed to reveal all four articles of the third segment, one of these small cones often being absent.

Of greatest interest are the hollow thin-walled sensilla basiconica which present four fundamental types of surface. They are adorned with either a smooth, pitted, spiraled, or longitudinally ridged surface. I described these apparently for the first time in 1937. Nägel (1892) plainly figured spirals on the sensilla basiconica of *Mamestra pisi* but failed to mention them in his text. Trägardh (1913) also included spirals and pits in his illustrations without, however, mentioning their presence. These four types of surface with their various modifications will be discussed at some length.

Very few species possess sensilla basiconica with smooth surfaces. Such as do, are for the most part members of the Rhopalocera. Where this type does occur, it is entirely possible that exceedingly minute punctations do exist; but to all intent and purposes the surface is smooth. Pitted or punctate surfaces occur more commonly, being present most widely among Rhopalocera and Limacodidae. The density and size of the punctations offer great diversity. At times it is impossible to distinguish this category from the next due to intergradations. While it is certain that these pits do not penetrate the walls of the sensillum, it cannot be stated positively whether they arise from the inner or outer surface. Spirals are by far the most common type encountered (Figs. 13 and 16). They occur in the vast majority of Heterocera but only exceptionally in the Rhopalocera. They may be either pronounced or faint, regular or irregular, fine or coarse. In some instances the spirals appear to consist of more or less continuous lines while in others they suggest short wavy discontinuous

lines aligned spirally. All sensilla examined exhibit spirals mounting the cone in a clockwise direction. To all appearances they are external sculpturings. Of more limited occurrence are the longitudinal ridges, these having been found only in Sphingidae where they are most pronounced, Saturniidae, some Citheroniidae, and two Psychidae (Figs. 58, 77, 79, and 128). The number of ridges to a cone is frequently six but varies within the species from four to seven. Smaller cones commonly have four. Also is there a diversity in the degree of development. An exceptional case is that of an undetermined sphingid (Fig. 86) in which the ridges exhibit a pronounced counter-clockwise spiral twist. Fine pits occur abundantly all over the cone. It is clearly seen that the ridges are internal thickenings. Usually sensilla with internal ridges possess in addition pits of various character. Commonly these pits are of the ordinary type though they range from fine to coarse punctations or to minute corrugations and evident spirals. An unmistakable indication that all types of sculpturing are here restricted to the cuticle and are not due immediately to sub-cuticular elements is the appearance of these marks unaltered in moulted head capsules. As yet sculpturing similar to that occurring on the sensilla basiconica has been found nowhere else.

MUSCULATURE

Lyonet stated that there were four muscles serving the antenna. Blanc found two muscles which he named adductor and abductor stating that they caused the antenna to be retracted. Snodgrass (1928) reported a single set of muscles. All of these authors are correct. There is a set of muscles attached to the anterior mesal edge of the base of the proximal antennal segment (Figs. 3 and 4). It is on the basis of this muscle attachment, among other things, that the possibility of the antacoria being a segment is discarded. It is my belief that the antacoria is the homologue of the other coriae separating the remaining segments. This set of muscles consists usually of three discreet bundles of which the first is often divided into two thus accounting for the four muscles described by Lyonet. Blanc recognized but two bundles which he designated as the adductor and abductor. The latter corresponds to my bundles one and two (Fig. 4). The third bundle which subdivides some distance proximad of the proximal end of the hypodermal bulb is inserted on the extreme anterior edge, that is, on the side bearing the third segment. The two remaining bundles are inserted slightly posterior to the third, that is, approximately on the

same side of the antenna as the long hair. The distance between the insertions of the two is equal to the diameter of one. All of the bundles spread fan-wise as they extend into the head capsule. In extending to the parietal region laterad of the adfrontal area the muscle bundles run anterior from the abductor muscles of the mandibles and posterior and laterad of the adductors of the mandibles (Fig. 2). The sole

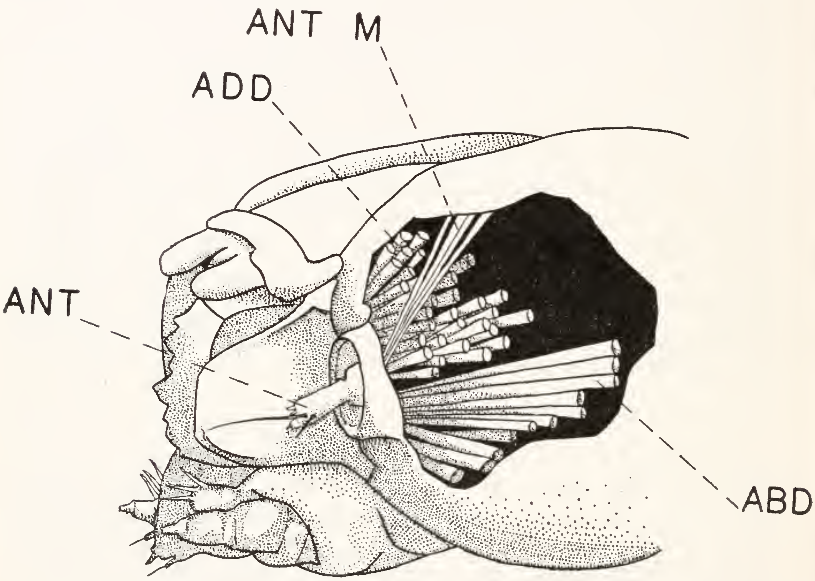

Fig. 2. Lateral view of the head of a larva showing the course of the antennal muscles. ANT M, antennal muscles; ADD, adductor muscles of the mandible; ABD, abductor muscles of the mandible; ANT, antenna.

function of these muscles is the withdrawal of the antenna within the head capsule. Demonstration is easily accomplished on the dead animal. Although the antenna may thus be moved as a whole, the individual segments are incapable of independent motion as they possess no muscles. However, all the segments articulate freely. Protrusion or extension of the antenna is regulated entirely by blood pressure. On the live animal this may be proved. If the cuticle is punctured in the region of the antacoria, the larva is unable to protrude its antennae and a quantity of blood is forced through the wound. With a dead animal the antennae may be forced out by applying pres-

sure to the head capsule thus forcing fluid into the antennal region. Unfortunately the fate of the muscles in the leaf-miners with reduced antennae is not yet clearly understood.

The antennae in common with the other organs of the head are supplied with tracheae which originate in the trunk from the prothoracic spiracle. A large antennal trachea coming more or less from the parietal region extends to the bulb of hypodermal tissue at the base of the antenna. Just before entering this bulb it divides equally into

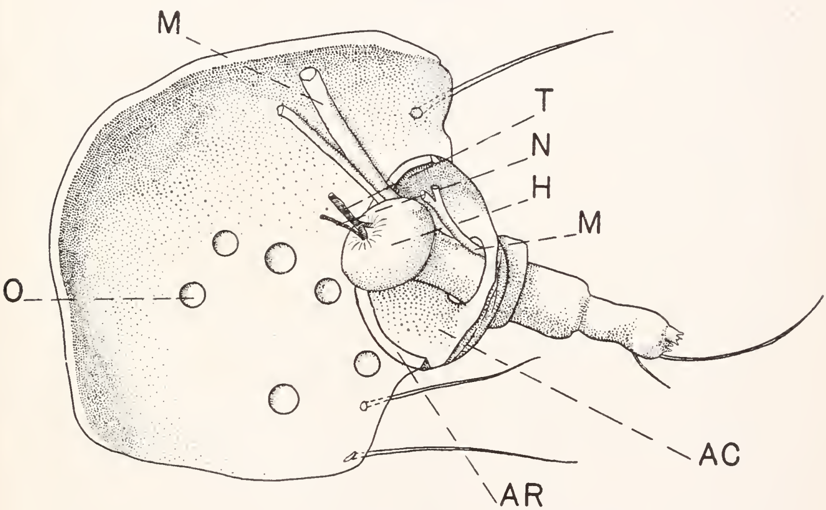

Fig. 3. Internal view of the head capsule illustrating the hypodermal bulb and the articulation of the antenna. O, ocellus; M, muscles; T, trachea; N, nerve; H, hypodermal bulb; AC, antacoria; AR, antennaria.

two branches which then enter the bulb. These immediately subdivide into two equal branches which extend but a short distance before they terminate as four conspicuous glomerulus-like swellings (Fig. 4). It appears that these swellings are simply a multitude of convoluted tracheoles arising suddenly from the same point. In only one case has a trachea been traced beyond this point. In this instance there were but three glomerulus-like swellings. However, minute tracheoles have been traced distally as far as the bases of the sensory cells innervating the sensilla on segment two. Occasionally a small trachea originating from other trunks within the head capsule supplies the muscles of the antenna.

INNERVATION

As is usual in insects the deutocerebrum gives off a single pair of nerves. Each nerve forks, emitting a basal branch that terminates in the region of the head capsule adjacent to the insertion of the antenna while the antennal branch innervates the antenna proper (Fig. 4). At least one small offshoot of the former extends directly to the hypodermal bulb where it subdivides on the surface of the hypodermis. The latter subdivides just before entering the hypodermal bulb. Its anterior division maintains its singularity until it has entered well into segment two. Here in the basal region of the segment (*Orthosia lota*), according to Henig (1931), a fiber diverges and crosses to the posterior region of the antenna where it innervates the shorter of the two sensilla trichodea. In the species which I examined this fiber took its departure from the more distal region of the nerve. At this junction the anterior division of the antennal branch divides forming two bundles of primary bipolar sense cells. The distal processes of the smaller bundle terminate at the base of one of the sensilla basiconica while those of the larger bundle enter segment three terminating at its tip.

The posterior division of the antennal branch gives off near its base a small nerve which directs an offshoot apparently to each of the tracheolar glomeruli. It then continues parallel with the anterior division. Somewhere in the first segment or just within the base of the second a single fiber takes its departure. This with its bipolar sense cell innervates the single sensillum campaniformium. Distal to this junction what appears to be another single fiber departs from the trunk to innervate the larger of the two hairs. As in the anterior division there is a separation at this point into two bundles of primary bipolar sense cells. The distal processes of the larger bundle terminate within the third segment while those of the smaller innervate the remaining large sensillum basiconicum (Fig. 5). It appears that a single fiber from this bundle serves the small sensillum basiconicum.

The species studied differ from *Orthosia lota* in several respects. First, the separation of the anterior and posterior divisions of the antennal branch takes place nearer the base of the hypodermal bulb, that is, not so deep within the head capsule. Second, no thickenings of these two divisions were observed. Third, Henig figured no branching in the vicinity of the tracheolar glomeruli. Fourth, the fibers to the two hairs and sensillum campaniformium originate within the second segment and not in segment one. McIndoo illustrated but a single exceedingly large bundle of fibers passing through segment one (*P.*

quinquemaculata), while in reality there are in this species two as already described.

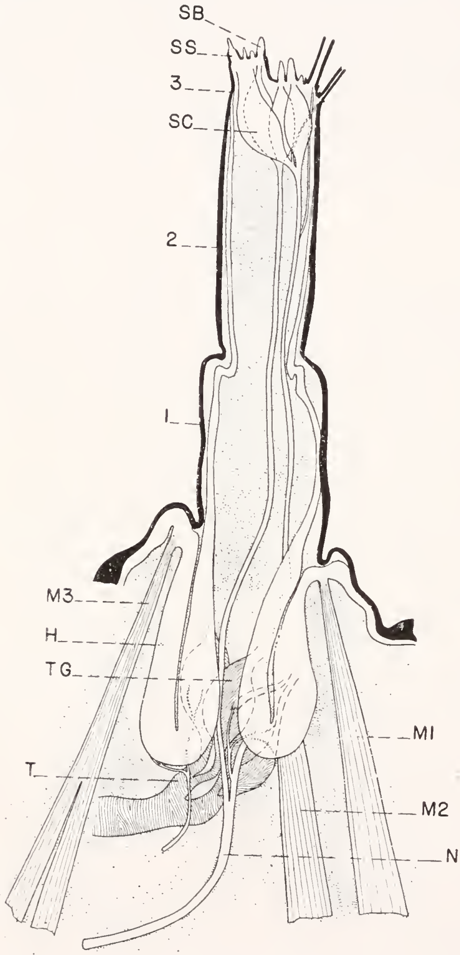

Fig. 4. Semidiagrammatic longitudinal section of the antenna. SB, sensillum basiconicum; SS, sensillum styloconicum; 3, segment three; SC, group of bipolar sense cells; 2, segment two; 1, segment one; M1, M2, and M3, first, second, and third muscle bundles; H, hypodermal bulb; T, trachea; TG, traceolar glomerulus; N, nerve.

The innervation of the antenna appears to be similar in all species. In the leaf-miners, where the greatest deviation is to be expected, the

groups of bipolar sense cells are proportionately larger filling the antenna entirely. In species in which the antennae have been drastically reduced (Figs. 125 and 126) the sense cells lie within the head capsule. In these cases their distal processes are longer than usual. As a result the antennal branch is extremely short. On the other hand, the hypodermal bulb becomes enormous. In some leaf-miners the bulb extends dorsally nearly one half the height of the head being many times longer than the antenna.

HISTOLOGY

Throughout its length the antenna is lined with hypodermis continuous with that of the head capsule. In the latter the hypodermis is simple columnar epithelium with conspicuous heavily stained orbicular nuclei. As the hypodermis approaches the region of the antacoria its cells rather suddenly become extremely large and rotund. Their nuclei are not in all cases appreciably larger. Proportionately, however, there is a vast amount of homogeneous cytoplasm. Where the cells approximate the points of muscle attachment they become very elongate forming closely packed pseudostratified columnar epithelium. This elongation and crowding produce an epithelium of great thickness. Here the hypodermis turning at right angles to the cuticle extends for a distance deep into the head capsule where it turns upon itself. Such convoluting produces the conspicuous hypodermal bulb (Figs. 3 and 4). The resulting two-layered epithelium as well as the difference between the antennal hypodermis and that of the head capsule was recognized by Blanc. From here the hypodermis extends in a more or less direct line into the antenna. By the time it reaches segment one it has thinned, resembling the hypodermis of the head capsule proper. Beyond this point additional thinning takes place till upon reaching the extremity of the antenna it is reduced to a mere sheet of squamous cells (Fig. 5). Thus there is a transition within the antenna proper from pseudo-stratified columnar to simple squamous epithelium. In this transition the nuclei become progressively more lightly stained being faintly and evenly granulated in the most distal cells.

Nervous tissue fills the greater part of the antenna at least distally (Fig. 5). The conspicuously nucleated neurilemma present on the nerves continues as a sheet around the aggregates of sensory cells. The number of sensory cells within a group varies and may reach twenty-five. These not overly large cells lie with their long axes

parallel to the axis of the antenna. All are more or less spindle-shaped containing prominent round to spindle-shaped nuclei. Peripherally

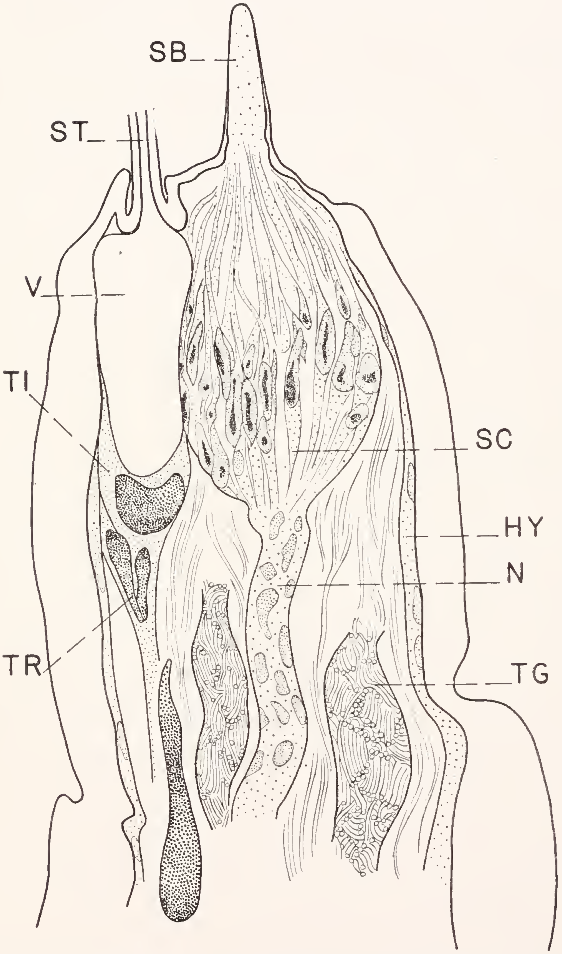

Fig. 5. Longitudinal section of segment two of the antenna. SB, sensillum basiconicum; ST, sensillum trichodeum; V, vacuole; SC, bipolar sense cell; TI, trichogen; TR, tormogen; HY, hypodermis; N. neurilemma of nerve; TG, tracheolar glomerulus.

these nuclei contain small evenly scattered darkly stained granules. Centrally they are more closely aggregated forming in each nucleus

an intensely darkly stained pseudonucleolus. The moderate to small amount of cytoplasm appears to be homogeneous. Distally the attenuations of the cells approach each other till they form a closely packed series of fine strands. Within these strands or distal processes are innumerable neurofibrils. It is probable that this nervous tissue accounts in part for the unidentified tissue that Blanc found present only in the antennae. Beyond the bases of the sensilla basiconica no distal processes have been traced. To all appearances they taper and disappear here. The interiors of the larger sensilla basiconica are filled with a clear liquid toward which the strands are directed. In the case of the bundles innervating segment three the distal processes of the cells have been traced as far as the bases of the sensilla. Occasionally minute indistinct thickenings have been seen in these processes which may presumably represent similar bodies termed Riechstäbschen by Vogel (1923). The proximal processes of the bipolar sense cells resemble exactly the distal processes, differing only in that they become compactly bundled together to form the nerve fibers. Moreover, Riechstäbschen never occur here.

The smallest sensillum basiconicum on segment three and that on segment two are to all appearances each innervated by a single bipolar sense cell lying within the aforementioned aggregations. This may also be the case with the sensillum styloconicum. There the fiber extends well into the base of the sensillum. The single cells innervating both sensilla trichodea are of the usual bipolar type. Occupying a large part of the antenna is an enormously long evacuolated trichogen (Fig. 5) belonging to the larger sensillum trichodeum. Its cytoplasm is confined to the proximal end which contains also the large heavily stained coarsely granulated nucleus. Present in addition is a smaller non-vacuolated tormogen (Fig. 5). Such cells as well as the bipolar cells serving the other sensilla were referred to as glands by Blanc. The bipolar sense cell to the large hair, while larger than the others present in the antenna, is quite similar. It lies at the basal part of the segment. With regard to the smaller sensillum trichodeum the situation is identical.

The trichogens of all the sensilla in segment three lie in segment two. As a rule only the vacuole and nucleus of each are visible as the cell boundaries are very indistinct. In the case of the three sensilla basiconica on segment two it is possible to discern the large vacuole through which the sensory processes extend. The nuclei of the trichogens and tormogens lie to one side of the sensory cells. Usually they may be distinguished by their large size and darkly stained coarse

granules. Cell boundaries are even more indistinct than those of the neurocytes.

At the base of segment two lies the sensillum campaniformium (Fig. 14). This is innervated by a single bipolar sense cell similar in nature to those already described. The fiber travels up the pore canal and perforates the inner endocuticular layer by way of an axial slit coming to lie just under the thin overlying epicuticle. Here the end of the distal process terminates as a minute refractive body. No trichogen or tormogen is present.

It is of interest to note that all the sense cells within the antennae are of the subepidermal type.

The remaining part of the antennal cavity contains numerous tracheoles and blood cells (Fig. 5). The former originate in the tracheolar glomeruli. These in turn arise from the tracheal trunks. They represent simply an intensive branching from one point on the trachea. The many tracheoles resulting from this branching lie in approximately parallel wavy lines although they twist and curve back upon themselves to a remarkable degree. In diameter they range from one to three micra. The whole structure resembles a spindle-shaped glomerulus. Proximately the flat polygonal cells of the tracheal epithelium are superseded by a number of scattered cells interspersed among the tracheoles. Distally the tracheoles singly or in groups of various sizes spread and anastamose through the antenna (Fig. 5). Few have been traced beyond the bases of the aggregations of sensory cells. In diameter they range from .2 to .5 micra. As in the glomeruli the larger ones are here associated with various sized spindle-shaped cells having large granular nuclei. The larger cells appear to lie on the surface of a group of these tracheoles while the smaller ones seem to lie upon single tracheoles. The terminations of the tracheoles lie in a fine network against nervous tissue and epithelium. Scattered throughout such a network are frequent large round blood cells.

Intimately associated with this network are numerous lenticular cells. It is possible, however, that what appear to be cells are merely their nuclei, their cytoplasm being drawn out with the ramifications of the network. The exact relation of these cells to the tracheoles cannot be determined with accuracy due to their extremely small size. The largest seldom exceed .75 micra in diameter. Blanc's undetermined tissue may also have included such a network as this. He described it as being formed of small star-shaped cells the prolongations of which anastomosed to form a delicate network of large mesh.

COMPARISON OF INSTARS

Many species of larvae were studied in all their instars in order to determine whether or not there was any variation from one stage to the next. In general those changes that do occur involve simply an increase in the size of the various parts, alteration in the size ratios of one part to another, and a change in the number of hairs exclusive of the usual two distal ones. The exceptional condition in the leaf-miners will be taken up later. The characteristic sculpturing of the sensilla basiconica exists unchanged in all instars. To better illustrate the changes that do take place from one instar to the next, a few representative cases have been selected for further consideration.

Grandi (1922 and 1923) studied two races of *Bombyx mori* and found that there is a progressive lengthening of the first and second segments as well as a progressive reduction in the length of the long hair on the second segment. On the other hand, the third segment does not progress with respect to age and in the fifth instar is proportionately shorter than in the first instar. The sensilla are not modified to any degree. The situation in *Platysamia cecropia* (Figs. 48, 52, 54, 56, and 58) is slightly different. In a series of measurements taken on all the instars of the same individual it was found that segment one increased in length from .06 mm. to .4 mm., segment two from .15 mm. to .8 mm., and segment three from .03 mm. to .05 mm. This means that the segments increased six and one half times, five times, and one and one-half times respectively. The ratio between segment one and two is practically constant throughout. The increase in length of segment three is almost negligible. Both the long and short hairs increase approximately five times (from .3 mm. to 1.45 mm. and from .08 mm. to .4 mm. respectively). In other words, unlike *B. mori*, the two hairs increase proportionately. All the sensilla grow but slightly (the largest sensillum basiconicum increases a trifle less than one and one-half times). *Malacosoma americanum* Fabr. is a species which possesses many hairs on the second segment in addition to the usual two, but unfortunately these caterpillars are very variable. As in the previous case, however, segments one and two increase in length in proportion to each other while segment three remains nearly the same size throughout all instars. Again the sensilla increase slightly less than one and one-half times in length, and the two hairs retain the same relationship to each other. In the embryo and the first instar there are but the two usual hairs on the distal end of the second segment. In the second and third instars from two to six hairs are added while

in the last there may be as many as eleven in addition to the usual two. In the case of *Apantesis arge* Dru. segments one and two retain their proportions while segment three enlarges but little. Again the largest sensillum basiconicum increases about one and four-tenths times. Like *B. mori* the long hair becomes progressively shorter in respect to the short one. In one instance the short hair increased three times in length while the long hair increased but twice so that the one to nine ratio in the early instar shifted to a one to six ratio in the last. In *Philosamia cynthia* the two hairs retain their relationship throughout the instars as do segments one and two. As in previous cases segment three enlarges only to a small degree while the largest sensillum basiconicum increases by only one and one-tenth times. Examples of *Papilio philenor* L. which were examined showed that the five auxiliary hairs present in the last instar were also present in the second.

ANOMALIES

While examining the thousands of antennae prepared for this study infrequent variations and abnormalities were noticed. These were confined to no special group of larvae but occurred sporadically throughout the order. By far the greatest percentage of variation occurred in the large sensilla basiconica. Variation was not necessarily present or identical on both antennae of the individual. Tanaka and Hino (1931) who studied variation in the antennae of *B. mori* recognized two types, namely meristic variation (variation in number) and symmetrical variation (variation in position). The former was of widest occurrence in the large sensilla basiconica. Of two hundred and eight antennae studied by these authors 31.3% were abnormal. Some 23% of these abnormalities occurred as meristic variation in the large sensilla basiconica (the unjointed papillae of Tanaka and Hino). From one to three supernumerary sensilla basiconica were found in fifteen cases. In but one instance was a sensillum basiconicum missing. I also have found only one case of this sort. In an undetermined species of phalaenid one antenna lacked a sensillum basiconicum while the other antenna was normal. I have not yet encountered as many as three supernumerary sensilla, but two occur occasionally. In the following species double large sensilla basiconica were found on segment two of one antenna: *Neophasia menapia*, *Achatodes zeae*, *Ceramica picta*, and an undetermined tortricid (Figs. 40, 69, 83, and 139). On segment three a similar condition was found in an undetermined geometrid (Fig. 112). Although Tanaka and Hino illustrated

cases in which the extra cone arose independently, I found that it usually arose from the base of one of the fixed cones. Various degrees of fusion existed between the normal and the extra cone. In many instances complete separation occurred (Fig. 83); in others the cones were fused on the basal three-quarters (Fig. 40). The supernumerary cones were sometimes equal in size to the fixed ones (Fig. 83), but usually they were noticeably smaller (Fig. 69). Meristic variation was next most common in the small sensillum basiconicum on segment two. Tanaka and Hino are in error in considering this as well as one of the small sensilla on segment three to be jointed papillae. The only sensillum that may be described as jointed is the sensillum styloconicum on segment three. An extra cone has been found in *Platysamia cecropia, Papilio glaucus,* and *Oxyptilus periscelidactylus* (Fig. 89). Here the extra sensillum arose independently (Figs. 19, 58, and 89), that is, not from the base of the fixed one. In *B. mori* no meristic variation was described for this sensillum. More often than not there is an extra small sensillum basiconicum in *P. cecropia* (Fig. 58). Meristic variation has also been found in the small sensilla basiconica on segment three (Figs. 13 and 84). Two supernumerary sensilla have been found in *Nymphalis antiopa* (Fig. 13). The absence of the expected sensilla has already been discussed (cf. p.471). Dampf reported several extraordinarily minute sensilla on the antennae of *Eumeta* sp?. The nearest approach to this condition was the presence on both antennae of two specimens of *Acrolepia cariosella* (Fig. 129) of ten to fourteen minute projections of the cuticle which resemble sensilla.

Further variations were of the symmetrical type, that is, variations in position. Tanaka and Hino found that nearly 50% of the variations in *B. mori* were of the symmetrical type. They found also that the more variable sensillum (papilla) was the small (jointed) one on segment two. Translocation took place around the posterior sensillum basiconicum (unjointed papilla) in a clockwise direction on the right antenna and a counter-clockwise direction on the left antenna. The hairs also varied in relative position, that is, they approached each other. To accomplish this the short hair was translocated. Variations of the sensilla on segment three were observed but not studied. When variations took place simultaneously, this condition was called "double variation" by these authors.

In the species studied here variation in position was found to take place in approximately the same percentage of cases as in *B. mori.* Since it conformed to that already noted, there is no need for further description.

Variation in the position of the sensillum campaniformium was slight both in degree and occurrence. It was more common along the axis of the antenna than at right angles to it.

Only two other types of anomalies remain to be discussed. Obata (1930) found among a total of 294 individuals of pure strain *B. mori* two instances of malformation of the antennae. Apparently one antenna was lacking, nothing but the antacoria being in evidence. According to the author this was a hereditary malformation. Rare cases have turned up in the course of these studies of animals with but one antenna or with a malformed antenna. These were observed in life. While the nature of the malformation suggested injury rather than inherent malformation it is difficult to imagine how such injury might have taken place. Cases have been noted, however, where difficulties at ecdysis have resulted in minor malformation. In succeeding moults such condition was usually remedied.

The last and most unusual anomalies to be reported accompanied prothetely, an abnormal condition due to partially accelerated metamorphosis, and metathetely, a condition due to partially retarded metamorphosis. Jones (1883) described a larva of *Melanippe montanata* that possessed fully developed adult legs and pectinate antennae. Kolbe (1903) in discussing prothetely in *Dendrolimus pini* L. gave a detailed account of curious bloated antennae which appeared to be many segmented. Dawson (1931) reported two cases of metathetely in *Telea polyphemus* Cram. in which the antennae became greatly distended with fluid and hence exceptionally large.

It seems remarkable that organs subject to such marked variation should exhibit such constant structure throughout the order. Just how constant the structure is may be appreciated from the detailed accounts based upon a study of the species listed below.

TAXONOMIC AND EVOLUTIONARY SIGNIFICANCE

Detailed Study of Species

The biological and phylogenetic considerations that follow this study of the species listed are based upon a thorough analysis of the data which form the basis for this study. Since the data in themselves are of little interest to most workers, I am presenting simply a condensed account in the form of a summary for each family.

Papilionidae
- *Papilio philenor* L.
- *P. ajax* L.
- *P. glaucus* form *turnus* L.
- *P. marcellus* Cram.

Pieridae
- *Colias philodice* Godt.
- *Neophasia menapia* F. & F.
- *Appias ilaire* Godt.
- *Pieris rapae* L.
- *P. brassicae* L.
- *P. oleracea* Harr.
- *Aporia crataegi* L.

Danaidae
- *Danaus plexippus* L.
- *D. berenice* Cram.
- *D. chrysippus* L.

Satyridae
- *Neonympha gemma* Hbn.
- *Megisto hermes* form *sosybius* Fabr.
- *M. eurytus* Fabr.
- *Coenonympha tullia* Hbn.

Morphidae
- *Morpho laertes* Druce

Nymphalidae
- *Euptoieta claudia* Cram.
- *Argynnis cybele* Fabr.
- *Brenthis myrina* Cram.
- *Nymphalis antiopa* L.
- *N. io* L.
- *N. urticae* L.
- *Vanessa atalanta* L.
- *V. virginiensis* Dru.
- *V. cardui* L.
- *Basilarchia arthemis* Dru.
- *B. astyanax* Fabr.
- *B. archippus* Cram.

Lycaenidae
- Plebeiinae
  - *Everes comyntas* Godt.
  - *Lycaenopsis pseudargiolus* Bdv. & Lec.

Hesperiidae
- Pyrginae
  - *Thorybes pylades* Scud.
- Hesperiinae
  - *Ancyloxypha numitor* Fabr.
  - *Hesperia leonardus* Harr.
  - *Polites manataaqua* Harr.
  - *P. themistocles* Latr.
  - *P. mystic* Scud.
  - *Catia otho* A. & S.
  - *Poanes hobomok* Harr.
  - *Calpodes ethlius* Cram.

Sphingidae
- Acherontiinae
  - *Phlegethontius quinquemaculata* Haw.
  - *Dolba hylaeus* Dru.
  - *Ceratomia catalpae* Bdv.
  - *Sphinx pinastri* L.
  - *Lapara coniferarum* A. & S.
  - *Smerinthus ocellatus* L.
  - *Mimas tiliae* L.

Isognathus sp?
Pachysphinx modesta Harr.
Pseudosphinx tetrio L.

Philampelinae
Pholus achemon Dru.
Ampeloeca myron Cram.

Choerocampinae
Celerio lineata Fabr.

Saturniidae
Platysamia cecropia L.
Callosamia promethea Dru.
Telea polyphemus Cram.
Automeris io Fabr.
Hemileuca maia Dru.
Philosamia cynthia Dru.

Citheroniidae
Anisota virginiensis Dru.
A. rubicunda Fabr.

Amatidae
Lycomorpha pholus Dru.
Ctenucha virginica Charp.
Syntomya thegea L.

Arctiidae
Arctiinae
Halisidota caryae Harr.
H. tessellaris A. & S.
Euchaetias egle Dru.
Eubaphe aurantiaca Hbn.
Phragmatobia fuliginosa L.
Apantesis virgo L.
A. arge Dru.
Diacrisia virginica Fabr.
Isia isabella A. & S.
Estigmene acrea Dru.
Hyphantria cunea Dru.
Ecpantheria deflorata Fabr.

Agaristidae
Alypia octomaculata Fabr.

Phalaenidae
Pantheinae
Charadra deridens Gn.
Raphia frater Grt.

Acronictinae
Acronicta americana Harr.
A. leporina vulpina Grt.
A. superans Gn.
A. impleta Wlk.
A. noctivaga Grt.
A. oblinita A. & S.
Simyra henrici
form *fumosa* Morr.
Harrisimemna trisignata Wlk.

Phalaeninae
Peridroma margaritosa
form *saucia* Hbn.

Hadeninae
Ceramica picta Harr.
Xanthopastis timais Cram.
Leucania pseudargyria Gn.
L. unipuncta Haw.

Cuculliinae
Cucullia convexipennis G. & R.
Eupsilia tristigmata Grt.

Amphipyrinae
Apamea velata Wlk.
Papaipema harrisi Grt.
Achatodes zeae Harr.
Pyrrhia umbra
race *experimens* Wlk.

Heliothiinae
Rhodophora florida Gn.

Plusiinae
Autographa brassicae Riley

Catocalinae
Catocala relicta Wlk.
Catocala sp?

Rivulinae
Rivula propinqualis Gn.

Herminiinae
Epizeuxis lituralis Hbn.

Notodontidae
- *Datana ministra* Dru.
- *D. perspicua* G. & R.
- *D. integerrima* G. & R.
- *Hyperaeschra stragula* Grt.
- *Nadata gibbosa* A. & S.
- *Symmerista albifrons* A. & S.
- *Heterocampa biundata* Wlk.
- *H. bilineata* Pack.
- *Fentonia marthesia* Cram.
- *Schizura ipomoeae* Dbldy.
- *S. concinna* A. & S.

Liparidae
- *Hemerocampa leucostigma* A. & S.
- *H. plagiata* Wlk.
- *Olene achatina* A. & S.
- *O. leucophaea* A. & S.
- *Liparis dispar* L.

Lasiocampidae
- *Malacosoma americanum* Fabr.
- *M. disstria* Hbn.

Bombycidae
- *Bombyx mori* L.

Zanolidae
- *Apatelodes angelica* Grt.

Geometridae
- Geometrinae
  - *Pseudoterpna pruniata* Hufn.
  - *Cheimatobia brumata* L.
- Sterrhinae
  - *Cosymbria pendularia* Cl.
- Ennominae
  - *Bapta temerata* Schiff.
  - *Deilinia pusaria* L.
  - *Erannis tiliaria* Harr.
  - *Euchlaena marginata* Minot
  - *Cingilia catenaria* Dru.

Psychidae
- *Oiketicus abboti* Grt.
- *Solenobia pineti*

Limacodidae
- *Parasa chloris* H. S.
- *Euclea delphinii* Bdv.
- *Phobetron pithecium* A. & S.
- *Prolimacodes badia* Hbn.

Megalopygidae
- *Megalopyge opercularis* A. & S.
- *Lagoa crispata* Pack.

Pyralidae
- Pyraustinae
  - *Pyrausta nubilalis* Hbn.
- Nymphulinae
  - *Nymphula maculalis* Clem.
  - *Eurrhypara urticata* L.
- Pyralinae
  - *Aglossa pinguinalis* L.
  - *Pyralis farinalis* L.
  - *Herculia intermedialis* Wlk.
- Galleriinae
  - *Galleria mellonella* L.
  - *Achroia grisella* Fabr.
- Phycitinae
  - *Myelois* sp?
  - *Ephestia kuehniella* Zell.
- Anerastiinae
  - *Anerastia lotella* Hbn.

Pterophoridae
- *Oxyptilus periscelidactylus* Fitch

Aegeriidae
- *Bembecia marginata* Harr.
- *Bemberia hylasiformis* Lasp.
- *Alcathoe apiformis* Clerck
- *Synanthedon exitiosa* Say
- *Melittia satyriniformis* Hbn.

Eucosmidae
Argyroploce variegana Hbn.
Eucosma foenella L.
Laspeyresia nigricana Steph.
Carpocapsa pomonella L.

Tortricidae
Sparganothis pilleriana Schiff.
Cacoccia cerasivorana Fitch.
Tortrix histrionana
T. forsterana Fabr.
Argyrotoxa bergmanniana L.
Peronea oxycoccana Pack.

Plutellidae
Acrolepia cariosella

Yponomeutidae
Yponomeuta sp?

Tischeriidae
Tischeria sp?

Gracilariidae
Lithocolletis robiniella Clem.
L. sp?
Gracilaria sp?

Lyonetiidae
Bucculatrix canadensisella Cham.
Phyllocnistis sp?

Tineidae
Tineola biselliella Hum.

Cossidae
Cossus ligniperda Fabr.

Nepticulidae
Nepticula sp?

Prodoxidae
Prodoxus quinquepunctellus Cham.

The following additional families are represented by the studies of other authors:

Micropterygidae
Eriocephala calthella L.
Mnemonica auricyanea Wlshm.

Adelidae
Adela degeerella L.

Glyphipterygidae
Simaëthis sp?

In addition many undetermined species have been studied. They include 4 nymphalids, 1 lycaenid, 4 sphingids, 4 arctiids, 36 phalaenids, 9 notodontids, 13 geometrids, 2 psychids, 2 pyralids, 2 aegeriids, and 10 tortricids.

In all cases antennae were removed from specimens preserved in 70% alcohol, dehydrated gradually in a series of alcohols, and cleared in xylol. They were then mounted in balsam in their entirety.

PAPILIONIDAE (Figs. 17–20, 24, 31, and 37). On the basis of the general appearance of the antennae and the relative lengths of their segments there seem to be two outstanding types in this family. There is little or no correlation between these and the various groups within the Papilionidae. One type is exemplified by the antennae of *P.*

glaucus (Fig. 24). In this species segment two is quite long and slender, being three and one-half times as long as segment one. The sensillum campaniformium or pore is located in the proximal quarter of the segment. The long hair is one-half again as long as segment two while the short hair is slightly less than one-third the length of the long one. The second type of antenna is characterized by a rather squat second segment which is approximately twice the length of the first. The pore is located just proximad of the middle. As a whole the family is characterized by the presence of a much reduced third segment, short blunt sensilla basiconica, and a sensillum styloconicum so reduced and poorly developed as to be almost completely overlooked. As a rule the sensilla basiconica may be said to possess smooth surfaces though oftentimes faint pits are visible. In *P. philenor* there are four supernumerary hairs of diverse lengths (Fig. 20).

PIERIDAE (Figs. 11, 12, 21, 27, 29, 34, 39, 40, and 47). As contrasted with the Papilionidae members of this family possess antennae with a short second segment. In such forms as *C. philodice*, *P. rapae*, *P. oleracea*, and *A. ilaire* (Figs. 21, 27, and 47) the second segment is about two and one-half times as long as the first, thus being relatively the same length as in the short antennae of the Papilionidae. In such forms as *P. brassicae*, *A. crataegi* (Fig. 29), and especially *N. menapia* the second segment is much more squat. In the latter group the pore is located near the middle of the segment while in the former it is found in the proximal third, with the exception of *P. oleracea* where it lies at the extreme base. The long hair varies in length from three and one-half to four and one-half times the length of segment two. In *N. menapia* (Fig. 12) where the segments are extremely short it is four times as long while in *P. brassicae*, where the segment is less squat (Fig. 29), the hair is four and one-half times the segmental length. The short hair ranges in length from one-fifth to one-half the length of the long one. Segment three exhibits normal development in all forms with the exception of *A. ilaire* (Fig. 47) where it tends to taper apically. The sensillum styloconicum is well developed and bears a long stout spine which is almost as thick basally as the tip of the cone upon which it is mounted. In *A. ilaire* (Fig. 34) the spine is long and slender. The sensilla basiconica which are more highly developed than in the Papilionidae do not exceed the condition which is normal for the order. Their surfaces contain pits in *C. philodice*, *P. rapae*, and apparently poorly formed spirals in *P. brassicae* and *A. ilaire*.

DANAIDAE (Figs. 23, 26, and 30). Here the second segment is approximately two and one-fourth times as long as the first with the pore located in the proximal third. The long hair is twice the length of segment two while the short one is one-third as long as its companion. Segment three is short, rounded, and not well developed. The sensilla basiconica show slightly subnormal development and crude spirals. The sensillum styloconicum is rather small. In *D. plexippus* (Fig. 30) there are three supernumerary hairs; in *D. berenice* (Fig. 26), six or seven extra hairs. In this respect *D. chrysippus* is similar to *D. plexippus*.

SATYRIDAE (Figs. 22, 32, 33, and 35). With the exception of *C. tullia* (Fig. 33) which has a shortened second segment, all species examined have the second segment at least three times as long as the first. The pore in *M. hermes* is situated at the tip of the segment while in *M. eurytus* (Fig. 22) it lies at the base. The long hair is slightly less than twice the length of segment two while the short hair is about one-sixth as long. Segment three is rather elongate. The sensilla basiconica are well developed and rather slender. Their surfaces are covered with minute pits. The sensillum styloconicum usually possesses a long, acute spine.

MORPHIDAE (Fig. 15). In this family the antennae fall midway between the two types of the Papilionidae as regards the relative lengths of the segments. The second segment is about one and one-half times as long as the first with its pore located in the distal quarter. The long hair is about three times as long as segment two while the short hair is one-third this length. Segment three is very well developed. The sensilla basiconica although not quite so squat as in the Papilionidae present the same general appearance. On their surfaces are many fine pores. On the other hand, the sensillum styloconicum is stout and well developed. The base of the spine is nearly equal in diameter to the top of the cone from which it arises.

NYMPHALIDAE (Figs. 13, 14, 16, 25, 36, 38, 41, 42, and 45). In species of *Basilarchia* the second antennal segment is of normal proportions. Though the pore is usually located proximally, some specimens of *B. archippus* bear a distally located pore. The long hair is one and one-fourth times as long as segment two; the short hair, one-third this length. Segment three is normal or moderate in development (Fig. 25). The sensillum styloconicum is similar to that of *P.*

brassicae. The sensilla basiconica are moderately developed, with pitted surfaces.

In species of *Nymphalis* (Figs. 13, 16, and 36) the second segment is shorter than in the above genus, and the pore is located proximally. Segment three is considerably shorter than in the preceding genus, and the spine of the sensillum styloconicum, stouter and poorly developed. Well marked spirals occur on the sensilla basiconica. The ratio of the lengths of hairs differs also. The longer is three times the length of segment two; the shorter, one-eighth as long as its companion.

Species of *Vanessa* (Figs. 42 and 45) show similar antennal characters with the following exceptions. Segment three is longer; the sensilla basiconica are faintly pitted; the sensillum styloconicum consists of a very prominent stout spine inserted in a much reduced basal cone.

Species of *Brenthis* and *Argynnis* (Figs. 38 and 41), of which first instar antennae were examined, possess large, well developed sensilla basiconica with very pronounced spirals. The sensillum styloconicum is normal in appearance.

The antennae of *E. claudia* resemble most closely those of *D. plexippus*. The two differ only in that the pore of the former lies just proximad of the midline; the relative length of the long and short hair differs by a small amount; there are seven extra hairs present. As in the case of *Danaus* the sensilla basiconica contain spirals.

LYCAENIDAE. The antennae are short in species of this family (Figs. 28 and 74). Segment two is but one and one-half times as long as segment one. The pore lies in the distal third of the segment; the sensilla basiconica are small, delicate, and pitted; the sensillum styloconicum, small; segment three, minute; the short hair not more than twice as long as the longest sensillum basiconicum.

HESPERIIDAE: Pyrginae (Figs. 55 and 59). Segment two bearing a centrally located pore is rather long. Segment three is longer than usual. The short hair is one-half the length of the long hair which in turn is two and one-third times longer than segment two. The sensillum styloconicum is small; the sensilla basiconica, moderate with doubtful spirals.

Hesperiinae (Figs. 43, 44, 46, 49, 50, 53, 57, 60–62). Segment two is of normal proportions with its pore located in the distal region of its middle third. The long hair is about two and one-third the length of segment two; the short hair, one-eighth as long. Segment three is

long and lacks one small sensillum basiconicum. All sensilla show moderate to good development. Most of the sensilla basiconica are weakly spiralled (Figs. 60–62). The spine on the sensillum styloconicum of *P. hobomok* is very long and tapering (Fig. 61).

SPHINGIDAE (Figs. 65, 71, 77, and 86). The antennae of this family are very characteristic. The first two segments are of approximately equal length. Segment three is very short and squat. The long hair is at most one-third again as long as segments one and two combined while the short hair is about one-sixth of this length. The pore lies in the basal fourth of the segment; the sensillum styloconicum is short and blunt; the large sensilla basiconica, short, squat, and rounded; the small ones, knobby. All species examined possess sensilla basiconica with ridges. In *A. myron*, *C. lineata*, and *P. quinquemaculata* there are pits in addition. The pits in *S. ocellatus* are very long and coarse. In *D. hylaeus* they are so long as to give the appearance of true connecting striae between the internal ridges. In *S. pinastri* there are wavy spirals in addition to the ridges.

SATURNIIDAE (Figs. 48, 51, 52, 54, 56, 58, and 79). The antennae of this family differ from those of the preceding in that segment one is relatively shorter, the third segment is slightly more developed, the ridges of the sensilla basiconica are less pronounced and usually only pits are found as additional adornment. The pore is located at the base of segment two.

CITHERONIIDAE. The antennae of the larvae of this family greatly resemble those of the preceding group. Segment two is about twice as long as the basal segment. The short hair is about one-sixth as long as the long hair which is twice the length of segment two. The pore lies in the basal fourth of the segment. The sensilla basiconica are not so blunt as those of the Saturniidae and are extremely wide at their bases. Those of *A. rubicunda* appear to possess coarse spirals while those of *A. virginiensis* (Fig. 70) apparently are faintly ridged and pitted. Although fairly well developed, the sensillum styloconicum is short and stout.

AMATIDAE (Fig. 78). Segment two is one and one-half times longer than segment one, and its pore is centrally located. Segment three is normal. The long hair is four and one-half times as long as segment two; the short hair, one-sixth of this length. The sensillum stylo-

conicum is modeled along the usual lines. The sensilla basiconica are not only exceptionally well developed, but they also exhibit beautiful clear-cut spirals.

ARCTIIDAE (Figs. 75, 87, 88, and 92). Antennae on the larvae of this family differ but slightly from those of the foregoing group. The sensilla basiconica while showing equally clear spirals are slightly less developed. Other notable variations include, for the most part, relative hair lengths. In *P. fuliginosa* the long hair is five and one-half times as long as segment two, and the short hair is one-fourth of this length. In *E. aurantiaca* the short hair is one-eighth as long as its companion hair which is three and one-half times as long as segment two. In *E. egle* (Fig. 75) the short hair possesses several microscopic serrations.

AGARISTIDAE (Fig. 73). In this family the antennae show decided phalaenid affinities. Segment two is two and one-fourth times as long as segment one. Segment three is of normal proportions. The long hair is three times as long as segment two and five and one-half times as long as the short hair. The pore lies at the base of the segment. Spiralled sensilla basiconica as well as other sensilla show moderate development.

PHALAENIDAE: Pantheinae (Fig. 109). Segment two is about thrice the length of segment one with its pore located basally. The short hair is one-fifth as long as the long hair which in turn is twice the length of segment two. Segment three is poorly developed. The usual sensilla exhibit normal development.

Acronictinae (Fig. 102). Segment two is but twice as long as segment one while segment three is more well developed than in the preceding subfamily. Otherwise there is little difference in the two groups. The spirally sculptured sensilla basiconica are of normal proportions but do not approach those of the Arctiidae in degree of development. In *H. trisignata* the spine of the sensillum styloconicum is rather long.

Phalaeninae (Fig. 107). Segment two is but one and one-half times as long as segment one. Segment three is quite well developed. The long hair is four and one-half times as long as the second segment while the short hair is equal to one-tenth of this length. The pore lies near the midpoint. Although the sensillum styloconicum is small, the sensilla basiconica almost approach those of the Arctiidae in degree of development.

Hadeninae (Figs. 64, 76, 82, 83, and 110). Segment two ranges in length from one to one and one-half times the length of segment one. The long hair may be from three and one-fourth to five times the length of segment two while the short hair is equal to one-eighth or one-seventh of this length. Segment three shows moderate development and the sensilla basiconica slightly better than normal development.

Cuculliinae (Fig. 66). In *E. tristigmata* segment two is long, segment three well developed, the pore located basally, and the sensilla basiconica well developed. In *C. convexipennis* (Fig. 66) segment two is short, but twice the length of segment one; the long hair is four times as long as segment two; the short hair is equal to one-seventh of this length; segment three is normal; the pore is in the basal half of the second segment; and the sensilla basiconica are of medium size.

Amphipyrinae (Figs. 68, 69, and 105). The length of segment two is at most one and one-half times that of segment one; more often the two are equal. Segment three exhibits no exceptional development or lack of development. The pore lies at the midpoint of the short second segment in *P. umbra* (Fig. 105) and at the base of the equally short segment in *A. zeae* (Fig. 69). In these two species the long hair is about five and one-half times as long as segment two, while the short hair is equal to one-sixth of this length. In *A. velata* (Fig. 68) the figures are four and one-half and one-seventh respectively. The spirally sculptured sensilla basiconica are of medium size.

Heliothiinae (Fig. 67). The antennae are similar proportionately to those of *P. umbra*. In spite of the fact that the pore lies in a more basal position the similarity between species of the subfamily and those of the preceding one is striking.

Plusiinae (Fig. 63). Here the second segment is proportionately larger than above. The sensilla basiconica are well developed.

Catocalinae (Fig. 103). Segment two is slightly more than twice as long as segment one. The long hair is equal to two and one-half times the length of the second segment and the short hair, equal to one-fourth of this length. Segment three is moderate as is also the sensillum styloconicum. The sensilla basiconica are well developed for this family.

Rivulinae. In *P. propinqualis* (Fig. 101) segment two is exceedingly long, measuring six times the length of segment one. Segment three is of the usual proportions. The long hair is one and six-tenths times as long as segment two while the short hair is equal to but one-tenth of this length. The pore is located at the extreme base of the segment.

NOTODONTIDAE (Figs. 80, 81, 84, 85, 98–100, 104, and 108). Segment two is usually half again as long as segment one. With the notable exception of *S. albifrons* (Fig. 108) where the pore lies just below the midline, the pore is located in the basal region of the segment. Segment three is of normal proportions. The long hair is not less than three-fourths again as long as segments one and two combined. The short hair is equal to one-eighth or one-fifth the length of the long hair. The latter in *D. perspicua* (Fig. 104) possesses a few microscopic serrations. The sensilla basiconica are as usual. The spine of the sensillum styloconicum is usually short. The whole antenna of *S. albifrons* is outstanding by virtue of its exceptional length and slenderness. With the exception of this species, *H. bilineata*, *S. ipomoeae*, and *S. concinna* where pores are found on the sensilla basiconica, all the species examined exhibited clear spirals on these sensilla.

LIPARIDAE (Fig. 106). Segment two is from three to four times as long as segment one. Segment three tends toward squatness. The spiralled sensilla basiconica do not reach the degree of development found in the majority of the Phalaenidae.

LASIOCAMPIDAE (Figs. 95 and 116). Segment two is not quite twice the length of segment one. The pore is located about midway on the segment. The long hair is from two and one-half to three times as long as segment two. Segment three and the spiralled sensilla basiconica are short. Usually *M. americanum* bears nine additional hairs. *M. disstria* (Fig. 116) bears from six to ten additional hairs.

BOMBYCIDAE. *B. mori* has been fully treated by Grandi (1922, 1923). The sensilla basiconica possess well defined spirals.

ZANOLIDAE (Figs. 146 and 148). The second segment is three times as long as the first. The third is of the usual proportions. Spiralled sensilla basiconica exhibit moderate development. The sensillum styloconicum is stout. Segment two bears the usual pore in its middle third. In addition to the long hair which is from two and one-half to three times the length of segment two, there are four supernumerary hairs.

GEOMETRIDAE (Figs. 96, 112, 115, 117, 120, 132, and 138). Segment two is from one and one-half to three and one-fourth (*P. pruniata*) times as long as segment one. The position of the pore varies.

In *P. pruniata* it lies in the distal fourth of the middle third; in *C. pendularia* in the proximal quarter; in *D. pusaria*, in the distal part of the proximal third; at the midpoint; or at the extreme base. The long hair is from two to four times as long as segment two, the usual length being twice that of the middle segment. The short hair is from one-fifth to one-twelfth as long. Segment three, though normal in many cases, varies considerably. It is longer than usual in *P. pruniata, D. pusaria,* and the undetermined species illustrated in Fig. 132. In the two unknown species represented in Figs. 115, 120, and 138 it is unquestionably bifurcate, bearing on one limb a large and small sensillum basiconicum, on the other a small sensillum basiconicum and the sensillum styloconicum. In one species (Fig. 115) the spiralled sensilla basiconica are extremely long, curved, and tapering; in the other (Fig. 120), of more usual size and shape. In most species they are well developed. In some, such as *C. pendularia,* they are exceptionally long and tapering.

PSYCHIDAE (Figs. 128, 133, and 141). In the antennae of species of this family segment two is twice the length of segment one. The latter is not only much reduced but is also weakly sclerotized. It does not seem capable of being protruded from the antacoria within which it lies. The pore is located approximately in the middle of segment two; the long hair is four times the length of this segment; the short hair, one-eighth this length. Segment three is of normal size. The sensillum styloconicum is short and stout; the sensilla basiconica, very squat. There is evidence of very faint longitudinal ridges on the surfaces of the latter. At any rate there are unquestionable pits present.

LIMACODIDAE (Figs. 114, 123, and 135). Members of this family are characterized by the presence of long slender antennae. The second segment is seldom more than one and one-fourth times the length of the first. The third is well developed. The pore of the second is invariably located on the extreme distal end. The long hair is never longer than segment two; the short hair, about one-fifth this length. The heavily pitted sensilla basiconica are moderately developed, while the sensillum styloconicum is well developed. Of the two small sensilla basiconica on segment three the longer has a tendency to be club-shaped or shallowly bifurcate in *Parasa*.

MEGALOPYGIDAE (Figs. 113 and 118). Segments one and two are of nearly equal length, with the pore located about midway on the

second. The long hair is equal in length to segment two; the short hair, from one-fifth to one-fourth of this length. The sensilla basiconica are of medium size with spirals present. On segment three the shortest one is absent. The sensillum styloconicum is well developed. Its moderately long stout spine is constricted at its base.

PYRALIDAE (Figs. 90, 93, 94, and 97). With the exception of the Nymphulinae, the second antennal segment in all forms studied ranges from one and one-fourth to one and three-fourths times as long as the first. Segment three is of the usual proportions. The pore lies approximately at the midpoint. In *C. brumata* it is basal in position. In *Aglossa* the spiralled sensilla basiconica are very robust. The sensillum styloconicum is also very large. In *P. nubilalis* (Fig. 97) the sensilla basiconica are slender, while in *P. farinalis* (Fig. 94) they are exceedingly stout at the base. The sensillum styloconicum possesses a long stout spine. This sensillum in *G. mellonella* is remarkably long and acute. In *Myclois* it is also long but stouter. In the aquatic *Nymphula* (Figs. 90 and 93) the antennae are long and slender. The second segment is two and one-half times as long as the first with its pore lying in the proximal portion of its distal third. This pore is distal to the small hair which is equal to about one-third the length of the long hair. The latter is from one and one-half to two times as long as segment two. Segment three, while not squat, is very small. The same is true of the spirally sculptured sensilla basiconica. The sensillum styloconicum is normal. On the apex of segment three more than three sensilla have never been seen. *Eurrhypara urticata* is closely related to *Nymphula* but is terrestrial. The second segment is at most twice as long as the first though the antenna is far from being either long or slender. The pore lies at the midpoint proximal to the short hair as is usual. The long hair is nearly four times the length of segment two, while the short hair is equal to but one-fifth of this length. Segment three is rather elongate; the sensillum styloconicum is very small; the spiralled sensilla basiconica, exceptionally large.

PTEROPHORIDAE (Fig. 89). Segment two is seldom more than two-thirds longer than segment one. Segment three is very long and narrow with a flaring apex. The long hair is three and three-fourths times as long as segment two and the short hair equal to one-eleventh of this length. The pore lies at the base of the segment. The pitted sensilla basiconica are of normal proportions. Although the sensillum styloconicum has no appreciable base, it bears a long spine.

AEGERIIDAE (Figs. 127, 140, 144, 145, and 147). Here is found a reversal of the usual linear proportions of the first two segments. The first, the largest in all dimensions, is usually twice as long as the second. Its pore is located in the distal portion of its proximal third. Segment three may be small or slightly elongate. The stout long hair is never noticeably longer than the length of the first two segments combined. The short hair is about one-seventh as long. The large stout sensilla basiconica possess many coarse spirals. On the sensillum styloconicum is found a long stout spine.

EUCOSMIDAE (Figs. 130 and 143). Segment one is from one and one-eighth to one and one-half times as long as segment two. The pore is located in the distal portion of the proximal third of segment two. Segment three is more elongate than usual. On the average the long hair is twice as long as segment two. On the same basis the short hair is one-sixth as long. In most species the sensillum styloconicum bears a long slender spine. The moderately developed sensilla basiconica are spiralled.

TORTRICIDAE (Figs. 111, 137, 139, and 142). Segment two is two and one-half times as long as segment one in a surprisingly large percentage of cases. The location of the pore is subject to considerable variation. In some species it lies at the base of segment two; in others, at the apex. Segment three is almost universally elongate. In some species it is one-half as long as segment two and in *S. pilleriana* (Fig. 137) is nearly half as long. In one undetermined species (Fig. 111) it is bifurcate to a noticeable degree. One limb bears the sensillum styloconicum; the other, the remaining sensilla. The sensillum styloconicum consists of a long base, a long spine, or both. The spiralled sensilla basiconica are of normal size in some cases and in others long or tapering. The long hair is from two and one-half to four and one-half times as long as segment two. The short hair may be one-eleventh, one-ninth, one-fifth, or one-fourth as long.

PLUTELLIDAE (Fig. 129). Segment two is twice as long as segment one. The pore lies approximately at the midpoint. The long hair is nearly five times as long as segment two. Segment three is normal as are all the sensilla.

YPONOMEUTIDAE. Forbes (1910) figured the antennae of *Y. cagnagellus.* They exhibit no unusual features.

HAPLOPTILIIDAE. In the mature larvae the antennae conform to type. The second segment, bearing a centrally located pore, is approximately one and one-half times as long as the first. The third is slightly elongate. The long hair is two and one-half times as long as segment two and the short hair equal to one-fifth of this length. Although the sensilla basiconica are normal, they are exceptionally blunt at their apices. The base of the sensillum styloconicum is long and stout.

TISCHERIIDAE. The antennae of *Tischeria* exhibit the usual characteristics. Segment one is usually longer than segment two and may be more or less permanently withdrawn into the antacoria (Trägardh, 1913). Segment three is well developed. It may even be elongate to a slight degree (Heinrich, 1918) as in *T. quercivorella.* The long hair is from one and one-half to two times as long as segment two. The short hair is equal to one-eighth or one-third of this length. All sensilla are well developed. In fact the sensilla basiconica are proportionally enormous.

GRACILARIIDAE (Figs. 121, 122, 124, 131, 134, and 136). In the younger larvae of *Lithocolletis* the antennae are slender and elongate (Fig. 121). The first two segments are of nearly equal length, with a pore located at the midpoint of the second. The slender third is also nearly as long as the others. It bears a prominent sensillum styloconicum with a short spine and two sensilla basiconica. The remaining two sensilla basiconica on segment two are large, curved, and adorned with coarse spirals. There may be in addition a small sensillum basiconicum or in its place a small hair. The long hair is present in some species and absent in others. In the older larvae of this genus some antennae resemble those of *Tischeria* where the first segment lies within the antacoria (Fig. 122). Others resemble young larvae of *Gracilaria* where the first segment is absent (Fig. 124). In the former all sensilla and hairs, with the occasional exception of one small sensillum basiconicum on segment three, are present. In the older larvae of *L. robiniella* (Fig. 134) the small sensillum basiconicum on segment two and the sensillum styloconicum on segment three are sometimes absent. In older larvae, in which there are but two segments to the antenna, the basal segment is usually but not always protruded from the antacoria. All sensilla and hairs may be present. Very often there is but one of the small sensilla basiconica present on segment three; less frequently both are lacking. The small one on segment two may

also be absent. The short hair is usually but not always present. In the first instar of *Acrocercops strigifinitella* (Heinrich and DeGryse, 1915) the basal segment is the shortest and the third the longest. Only the two very large sensilla basiconica on segment two and a large and small one on segment three are present. In the last instar all the usual sensilla with the exception of a small sensillum basiconicum on segment three are present. The short hair is about one-half as long as the long one which in turn, though twice as long as segment two, does not extend beyond the tip of the antenna. In young *Ornix* the sensillum styloconicum and two small sensilla basiconica are absent. In the mature larva of *Gracilaria* there are found fully developed antennae. Segment one is about equal in length to segment two. The curved long hair is about three and one-half times as long as segment two while the short hair is equal to one-quarter of this length. Segment three is as long as the short second segment. All the sensilla, including the long sensillum styloconicum, are well developed. One small sensillum basiconicum is wanting. In young larvae the antennae are greatly reduced. The first segment is usually totally absent. No sensillum styloconicum appears on the rather small third segment.

LYONETIIDAE. In young larvae of *Phyllocnistis* the third segment and the long hair are absent. Remaining are simply two large sensilla basiconica, one minute one, and the small hair (Trägardh, 1913). In the last instar (Fig. 125) there remain only two large sensilla basiconica, the long hair, and occasionally what may be either a minute sensillum basiconicum or the short hair. The mature larvae of *Bucculatrix canadensisella* have antennae of the usual type. The sensilla basiconica are large, the third segment small, and the long hair about three and one-half times as long as the second segment. In *Proleucoptera albella* Cham. the antenna is a mere cushion from which arise one long hair, two minute sensilla basiconica, and a slightly elongate third segment bearing two sensilla basiconica and the rudiment of a sensillum styloconicum (Heinrich, 1918).

TINEIDAE. In *T. bisselliella* the antennae are short. The second segment is one and three-fourths times as long as the first. The third is of the usual proportions. Contrary to the findings of Dampf (1910) a pore is present, being located approximately at the midpoint of segment two. The long hair is six and one-third times as long as segment two; the short hair, equal to one-eleventh of this length. All of the usual sensilla are present. One of the large coarsely spiralled

sensilla basiconica on segment two is relatively enormous. On segment three the large sensillum basiconicum is normal and the two small cones minute. The spine of the sensillum styloconicum is exceedingly long being nearly equal to segment two in length.

COSSIDAE (Fig. 119). Segment one is the largest segment in all dimensions. It is one and one-half times as long as segment two. On the latter is a centrally located pore. The long hair is three and three-fourths times as long as segment two and the short hair equal to one-fourteenth of this length. Segment three is normal; the pitted sensilla basiconica, stout; the sensillum styloconicum, small.

NEPTICULIDAE (Fig. 126). In the last instar larvae of the genus *Nepticula* the antennae are reduced to single segment joined to the head capsule by means of an inconspicuous antacoria. Two large globe-shaped sensilla basiconica are present. They possess very pronounced bases indicated by a thickening of the cuticle and are either weakly pitted or spiralled. The remaining sensilla consist of a long hair, sometimes a short hair, and one or two minute sensilla basiconica. In *Opostega nonstrigella* and *Ectoedemia phleophaga* the antenna have undergone comparable reduction.

ADELIDAE. In *Adela* the antennae are of the usual type. All the sensilla are present and moderately developed (cf. Dampf, 1910).

PRODOXIDAE (Fig. 91). The antennae of *P. quinquepunctellus* are also of the usual type. The long hair is about equal to segment two in length. The short hair is about one-half as long. Segment three though rudimentary lacks but one small sensillum basiconicum. A large sensillum styloconicum with a reduced base is present. All large sensilla basiconica are of moderate size and heavily pitted.

MICROPTERYGIDAE. The antennae of mature larvae of *Mnemonica auricyanea* are of the usual leaf-miner type. The second segment bears the customary sensilla; the third bears three sensilla. Of these the sensilla basiconica are large and pitted. In *Eriocephala calthella* the antennae approach the opposite extreme as far as length is concerned. They are exceptionally long. Unfortunately no specimens were available for study. It is necessary, therefore, to base the following remarks on the figures and descriptions of Chapman (1894) (Fig. 151) and Packard (1895) (Fig. 153). Segment one is of the type common to lepidopterous larvae. Segment two is from two to three

times as long. Apparently there is a small hair located below its midpoint. In addition the segment bears at least one globe-shaped sensillum basiconicum. Segment three is not eccentrically placed as it is in all Lepidoptera. It bears at least three sensilla of which one, long and spine-like in appearance, is probably homologous with the sensillum styloconicum. The antennae of *Sabatinca barbarica* Philp. (Fig. 150) are of the same general configuration.

Biological Considerations

Aside from the fact that the examination just completed emphasizes the uniformity of antennal structure throughout the Lepidoptera, it also indicates, first, that certain family tendencies of a more or less broad nature may be indicated by antennal structure; second, that in a large number of cases uniformity of certain features may be found within a genus; third, that specific differences may be great (e.g. *Pyrausta nubilalis* and *P. farinalis*) or practically non-existent (e.g. *Basilarchia*). It is necessary to conclude, therefore, that antennae are of limited and doubtful taxonomic value in the determination of families and of practically no taxonomic value, with rare exceptions, in the lower categories. It is possible in many cases to outline family characters which may serve as fair criteria. For example, with one or two exceptions longitudinal ridges on the sensilla basiconica may be said to characterize the Saturniidae and Sphingidae; the Tortricidae are distinguished by the unusual length of the third antennal segment; the Limacodidae are characterized by the possession of extremely thin elongate antennae; the Aegeriidae and Cossidae are noted for the fact that segment one is usually the largest.

On the other hand, certain phylogenetic relationships are illustrated by the antennae. These are simply pointed out as suggestions for further consideration. There is a striking resemblance between the antennae of the Papilionidae and the Morphidae. Those of the Pieridae resemble the antennae of Satyridae more than Papilionidae. Bodine (1896) found that the antennae of the adults also indicate a lack of close relationship between the Pieridae and the Papilionidae. He found, moreover, that the former resemble Nymphalidae. In the larval antennae of the Nymphalidae there exists a lack of uniformity that suggests several groups instead of one. *Brenthis* and *Argynnis,* for example, differ noticeably from other members of the family. The presence of supernumerary hairs in *P. philenor, Danaus* spp., and *E. claudia* can not be held as significant since a similar condition is found

in *Malacosoma* spp., and *Angelica* spp. The Hesperiidae resemble the butterflies more closely than the moths, as is to be expected.

The remarkable similarity between the Sphingidae and Saturniidae has already been dwelt upon. There is no such relationship indicated by the antennae of the adults (Bodine 1896). The Citheroniidae, though resembling the two above mentioned families, can readily be distinguished from them. Similarities between the Amatidae and Arctiidae are self-evident. There is a degree of similarity between the Limacodidae and Megalopygidae which is also indicated by the adult antennae (Bodine, 1896). The Agaristidae resemble the Phalaenidae. The adult antennae also show this relationship (Bodine, 1896). Due to the heterogeneity encountered in the Phalaenidae, however, very few conclusions can be drawn. There are no antennal features characterizing the numerous subfamilies. The same is true of the other large families.

Next to be considered is a possible correlation between feeding habits or mode of living and antennal structure. For the purposes of this discussion the larvae of Lepidoptera may be divided into external feeders and internal feeders. Of these the first division includes species of polyphagous, oligophagous, and monophagous food habits. With these three categories in mind it is not difficult to see that the most highly developed sensilla basiconica, the predominent type of sensillum on the larval lepidopterous antenna, occur in the Arctiidae, Amatidae, Phalaenidae, Agaristidae, Geometridae, Tortricidae, and Pyralidae. The vast majority of species in these families are polyphagous, utilizing quite varied food plants. Such groups as exhibit oligophagous, more or less restricted, feeding habits like the Papilionidae, Pieridae, Danaidae, and Sphingidae are characterized by more poorly developed sensilla basiconica. There are, nevertheless, as many exceptions as conformities to this situation. Saturniidae, Hesperiidae, and Liparidae, containing an abundance of polyphagous species, are characterized, however, by poorly developed sensilla basiconica. In direct contrast to this are species of *Argynnis* and *Brenthis* which confine their feeding to *Viola* or *Passiflora* and are characterized by the presence of well developed sensilla basiconica. There does not seem, therefore, to be any valid correlation between feeding habits in external feeders and the degree of development found in the sensilla basiconica.

Internal feeders may be divided into borers and leaf-miners. In the former (e.g. Aegeriidae and Cossidae) the antennae have the second segment reduced, that is, the basal segment is much longer than is

usually the case. The length of the two stout hairs, especially of the short hair, is greatly reduced. The sensilla basiconica tend to be stouter than in external feeders. This condition to some extent foreshadows that found in the leaf-miners. The leaf-mining habit is always accompanied by a reduction in the antennae. Just how valid the correlation is may be seen by the fact that of several closely related forms only those that have become miners exhibit reduction. Also those larvae that are leaf-miners at certain stages only, possess reduced antennae only during specific stages. Thus, the type and amount of reduction varies not only in different species but also in different instars of the same species. Likewise reduction, though it implies loss, might just as well represent a fusion of segments, since, as Trägardh (1913) pointed out, this reduction occurs both basally in the loss of segment one and apically in the loss of segment three. Of all the sensilla present the hairs and sensillum styloconicum are most apt to be absent. The minute sensilla basiconica are upon occasion absent, but only most rarely are the large sensilla basiconica reduced in number. Of the three normally present there are but two in *Nepticula* and *Phyllocnistis*. It is difficult to ascertain which of the three has been lost. There is a possibility that one of the two belonging to segment two is absent and that the remaining two represent one from segment two and the single one from segment three. In some last instar larvae of *Lithocolletis robiniella* one of the large sensilla basiconica from segment two has been lost. It can be seen that of all the antennal structures the large sensilla basiconica are the most conservative. Whether or not this argues for their importance is an open question. It is evident, however, that the tendency to reduce the antenna accompanies the adaptation of a restricted habitat as is the case in borers and leaf miners.

Also unusual but far less unorthodox than the antennae of leaf-miners are those of the Limacodidae. As has been pointed out they are exceptionally long and slender. The larvae are of the slug type, that is, they usually carry their heads withdrawn well within the prothorax. For caterpillars of this type long antennae are particularly well adapted. However, the Lycaenidae examined do not possess antennae of unusual length although their larvae are of the slug type also.

Finally there are the case-bearers and aquatic forms which will be discussed later in comparison with Trichoptera.

From these studies we see that the antennae of lepidopterous larvae, leaf-miners excepted, are not greatly modified with changes in

feeding habits or mode of living. This is to be expected in organs of such a conservative group as this. It might be well to point out in this connection that the antennae are one of the best taxonomic characters for the separation of lepidopterous larvae from those of all other orders.

Comparison with Other Orders

The confusing resemblance between lepidopterous larvae and the larvae of some other holometabolous insects has led to considerable investigation of all immature forms. Upon the basis of studies of this nature much speculation as to evolutionary trends as exemplified by larvae has been advanced. It is interesting to study briefly the antennae of larvae representing the more important holometabolous orders in order to determine whether or not these particular appendages shed any further light upon the problem of phylogeny. With this end in mind, therefore, a general study of the antennae has been undertaken.

MEGALOPTERA. The antennae of *Corydalis cornutus* L. may be taken to represent the general type found in this order. Of the five antennal segments the first or basal one is the shortest and broadest. Its diameter is slightly greater than its length. The only sensilla present upon it are a few small sensilla campaniformia. The antennal muscles are inserted on the basal edge of this segment which articulates with the head capsule by means of a small antacoria. The coria between this and segment two is not only heavily sclerotized but merges so gradually into the segments that there might be a tendency to overlook the existence of the basal segment as an independent article. Segment two is about six times the length of segment one. Besides being noticeably narrower it tends to flare slightly toward the apex. Particularly conspicuous at the base of this segment are several medium sized sensilla campaniformia. Scattered over the remainder of the segment are a number of smaller less conspicuous ones. Distally at the base of the coria or intersegmental membrane are numerous delicate thin-walled spine-like hairs of varying length. On the basis of location alone it might rashly be suggested that these function as do Pringle's "hair plates" (1938a), that is, position- or proprioceptors. Segment three is similar in shape, length, and type of sensilla borne to segment two. It differs in being much narrower. Segment four is narrower and about one-half as long as the preceding segment. Distally it bears a prominent sensillum campaniformium.

Segment five is of about the same length, narrower, and tapering. Distally it also bears a prominent sensillum campaniformium.

RAPHIDIODEA (*Inocellia* sp?). Although the antennae of this larva are reputed to be three-segmented, there are actually four segments (Fig. 149). The small second segment is made inconspicuous by reason of its being sunk into the coria separating it from segment one. The antacoria is large and conspicuous. Here also the antennal muscles are inserted on the basal edge of segment one which more or less superficially resembles the second segment of lepidopterous larvae. Near its base it contains two or three inconspicuous sensilla campaniformia. Scattered over its entire surface are numerous minute sensilla trichodea of various sizes. On the side of the segment bearing segment two there is a row of longer sensilla trichodea. All of these are exceedingly delicate and thin-walled. On the apex of the segment is a galaxy of sensilla trichodea some of which are longer than segment three. Joint two had been overlooked by earlier observers. It is a true segment arising eccentrically, that is, off-center from segment one. Being very short it is often wider than long. From it arises the third segment which although slightly smaller in diameter basally, flares to a considerable degree apically. Scattered over its surface are minute sensilla trichodea, while on its apex is found the usual group of prominent sensilla trichodea. Segment four, while similar to its predecessor in shape, is narrower and shorter. On its tip is a number of delicate sensilla trichodea. These consist of a short pair, a long pair, and a most conspicuous sensillum styloconicum.

NEUROPTERA (*Chrysopa* sp?). Segment one, upon which the antennal muscles are inserted, is of the usual short, squat type characterized by the presence of several sensilla campaniformia. Segment two is long and tapering. Its basal quarter and apical eighth are free from the sclerotized annulations characteristic of its greater length. Whether or not these merit the term of segments is a moot question. Between some there exist well defined coriae, while others are delimited simply by areas of slightly less sclerotization. The distal portion of the segment bears three or more minute scattered sensilla trichodea. Near the tip is a large acute hair. Just distal to this is a tympanum-like area which may be an enormous sensillum campaniformium or placodeum. The terminal segment bears a small median sensillum campaniformium and four apical sensilla trichodea.

(*Myrmeleon* sp?). The basal segment is somewhat elongate and

bears several sensilla campaniformia. Following this are thirteen to fourteen short segments forming a filiform flagellum. Apparently they possess no sensilla of any kind. The terminal segment is nearly as long as the second segment. It bears a pair of medium-sized delicate sensilla trichodea in addition to a larger blunt-tipped cone.

In Mantispidae and Berothidae the antennae are three, four, or five-jointed with long setiform terminal joints. The antennae in Polystoechotidae are not only shorter but stouter. The basal joint conforms to type. Following this are several more or less imbricated joints or joint-like divisions surmounted by a barrel-shaped article. As is to be expected the terminal joint bears the usual type of sensilla.

In Psychopsidae the antennae are from eight to ten-jointed with the usual sensilla-bearing terminal joint.

The antennae of the Nymphidae are filiform. Nemopteridae and Ascalaphidae possess many-jointed filiform antennae with sensilla trichodea and campaniformia.

In summary it may be said that the Neuroptera are characterized by the presence of a many-segmented filiform antenna. There is a small antacoria into which the first segment is inserted. For the most part the basal segment is squat. It bears a varying number of sensilla campaniformia. Distal to the basal joint is a long, usually filiform joint with a various amount of sclerotization in the form of annulations or a series of short well-defined segments. For the most part this section of the antenna bears no sensilla. The penultimate segment often bears a conspicuous sensillum trichodeum. In addition there may be several smaller sensilla of this type. Finally the terminal segment characteristically bears a few delicate sensilla trichodea and one or more sensilla campaniformia.

The antennae found in the three foregoing orders, in spite of some obvious differences, are more nearly alike than like those of any other order. All possess four or more segments of a fairly generalized type. Sensilla trichodea and campaniformia predominate. In the Megaloptera the segments are very simple and do not usually exceed five in number. In the Raphidiodea there is found essentially the same type of antenna. There are four segments differeing from those of the preceding order mainly in being of greater relative diameter. The apparent intersegmental hairs are found in both groups. If any further conclusions could be drawn, they would tend to indicate that the antentenae of the Megaloptera were less specialized than those of the Raphidiodea.

Neuropterous antennae, on the other hand, represent a rather dis-

tinct type. Outstanding is the small basal segment or scape, reminescent of the antennae of most adult insects. The remainder of the antenna is filiform, resembling adult antennae more than larval antennae of any sort. Whether the sclerotized rings represent the initiation of a more marked segmentation or of segmental reduction by fusion is difficult to say. The latter suggestion is probably nearer the truth. Based upon current ideas of what is primitive and what is specialized the indications are that the antennae of these three orders may be listed in order of decreasing primitiveness as follows: Megaloptera, Raphidiodea, Neuroptera.

MECOPTERA. Antennae of larvae of *Boreus, Bittacus, Panorpa,* and *Chorista* representing the families Boreidae, Bittacidae, and Panorpidae were examined. Inasmuch as they differ in minor respects only, a detailed description will be given of but one, namely, an undetermined species of *Panorpa.*

The short awl-shaped antennae are inserted on the genae between the antecoxal mandibular suture and the dorsal edge of the eyes above the fronto-clypeal suture. They rest in a conspicuous antacoria. A prominent antennaria (basantenna of Steiner [1930]) is present here as well as in Neuroptera. The concensus of opinion is that this is not a true basal sclerite of the antenna but simply a thickening of the cranium. The antenna itself is composed of three segments. The first (scape of Steiner) is cylindrical and collar-shaped. Its diameter is greater than its height. On it are four sensilla campaniformia. Segment two (pedicel of Steiner) is about twice as long as segment one. It is awl-shaped. The thin-walled distal area bears from twenty to thirty-five very large closely adjacent sensilla campaniformia. These lie in two opposite groups of several rows each. Also present in this area is a sensillum campaniformium of the same type as on segment one. Segment three (funiculus of Steiner) is more or less cigar-shaped. At its tip it bears three to five small delicate sensilla trichodea. The antennal muscles are inserted on the basal edge of the first segment.

TRICHOPTERA (Figs. 152 and 154). Though the antennae of all these larvae are characterized by great reduction, they differ remarkably not only in the several families but also in the various genera (Silfvenius, 1903–1905). In the Hydroptilidae the antennae are one-segmented. They are borne on a reduced antacoria bordered by a very strongly developed antennaria. Some forms (e.g. *Agraylea multipuncta* Curt.) bear a single sensillum trichodeum usually located dis-

tally and a pale finger-like projection which may be a very thin-walled sensillum basiconicum (Fig. 152). *Ithytrichia lamellaris* Eat. bears a proximal hair, a more or less distal sensillum campaniformium, and in addition to the supposed sensillum basiconicum another thin-walled projection. *Neureclepsis* bears three hairs and a short peg.

In the Phryganeidae the antennae again are one-segmented. Most, such as *Phryganea minor* Curt., bear a small terminal sensillum tricodeum and a supposed sensillum basiconicum. There may also be a sensillum campaniformium as in *Agrypnia pogetana* Curt. and two sensilla campaniformia on the antennaria.

The Limnophilidae for the most part possess a minute one-segmented antenna bearing no visible sensilla (Fig. 154). Some forms such as *Limnophilus extricatus* possess both bristle and finger-like projections. The same is true of members of the Sericostomatidae (e.g. *Brachycentrus subnubilus* Curt.). Some Molannidae have antennae consisting of a wide basal segment and a delicate terminal segment bearing a bristle and a rod-like sensillum. The antennae of the Leptoceridae are also two-segmented. In *Tinodes* (Psychomyiidae) the antennae are exceedingly minute. In *Mystacides* the antennae are quite large due to the length of the so-called finger-like distal segment. The antennae of the Philopotamidae bear three delicate bristles and two rod-like sensilla. Most of the Rhyacophilidae possess antennae even more reduced than usual. All that remains is a membranous area in the head capsule which may or may not be slightly elevated. This bears a varying number of delicate sensilla trichodea and a curious rod-like sensillum or even sensillum basiconicum.

In the Polycentropodidae there may be three hairs and from one to three rods.

The antennae differ in the various instars, being either more or less complex in the first instar than in the last.

Of the antennae of these two orders those of the Mecoptera are without a question more like those of the Lepidoptera which they resemble more closely than do those of any other order.

The similarity consists of an equality in the number and gross shape of the segments as well as in the uniformity present throughout the order. Differences such as the inequality of shape of the apex of segment two (in the Lepidoptera it is predominantly flat-topped; in the Mecoptera, rounded), the location of segment three (in Lepidoptera it is not centrally located in the majority of forms), the absence of sensilla basiconica, and the presence of very remarkable area of sensilla campaniformia in Mecoptera, is offset by other at least equally signifi-

cant similarities such as the presence of four sensilla campaniformia on segment one of Mecoptera and some Lepidoptera, the presence of a similar type of sensillum campaniformium on segment two, the absence of apparent intersegmental hairs or bristles. The absence of sensilla basiconica in the Mecoptera is not to be wondered at, because apparently such organs are more characteristic of higher orders. They also occur, for example, in the Coleoptera.

One curious, if not disconcerting, fact remains to be presented. That is that the antennae of mecopterous larvae resemble more nearly those of the Frenatae than those of the obviously primitive Jugatae. This is seen in the large diameter of segment two and the presence of the sensilla on segment one. On the other hand, the third antennal segment of such primitive Lepidoptera as *Sabatinca barbarica* Philp., to judge from Tillyard's description, is more or less centrally located. While Tillyard (1922) also observed the close similarity between the antennae of *S. barbarica* and those of primitive Mecoptera (*Chorista* and *Panorpa*), he too noticed that though the second antennal segment of the former was slender the corresponding segment of the latter was large, dome-like, and filled internally with an enormous mass of nerve cells which he declared formed a large Johnston's organ. He stressed the definite relationship between the two forms. "— *Sabatinca* is, on the whole, more archaic in its early stages than any existing Panorpoid insects excepting only the Mecoptera. The larva shows on the whole a preponderance of Mecopterous characters, but is more highly specialized than the typical Mecopterous larva in all points, except only in the form of the antennae."!

That *Sabatinca,* which is closely related to *Micropteryx*, seems to have nothing in common with the Eriocraniinae may be due to the fact that the latter have become specialized for a leaf-mining mode of life. Thus since *Micropteryx* and *Sabatinca,* which are closely related, are free living forms, it is to be expected that they should exhibit similar types of antennae. Since *Eriocrania* and *Mnemonica* are, on the other hand, leaf-miners, it is likewise to be expected that they possess antennae typical of leaf-miners and dissimilar to the above-mentioned genera.

The outstanding characteristics of the trichopterous larval antennae are extreme reduction and simplicity. The antennae show absolutely no affinities with those of the Lepidoptera or of the Mecoptera. Tillyard reached the same conclusion and noted that the Trichoptera are specialized for an aquatic existence. He also stated that *Sabatinca* represents a larval type much more archaic in most points than that

of the Trichoptera. That the simplicity of the trichopterous antenna may have gone hand in hand with an aquatic environment or with a case-bearing habit warrants further investigation. Fortunately there are aquatic and case-bearing Lepidoptera available for examination, as well as aquatic Coleoptera.

A study of such aquatic larvae as those of the genus *Nymphula* reveals that the antennae are long and slender. In terrestrial species of the closely related genus *Eurrhypara* they are of the usual form. The ratio of one segment to another ordinarily differs so much in closely related species that the differences noted here between terrestrial and aquatic species is not significant. The antennae of many aquatic coleopterous larvae are also greatly attenuated, but unusual length and slenderness is likewise found in terrestrial forms. The antennae of case-bearing lepidopterous larvae exhibit no unusual reduction. It is perfectly true that such factors as an aquatic environment and a case-bearing habit might operate differently in different groups of insects. In my opinion, however, the extreme reduction of larval antennae in Trichoptera is merely coincidental with the mode of existence. The dissimilarity between the antennae of Trichoptera and Lepidoptera is all the more significant for this reason and emphasizes the fact that lepidopterous larvae are more closely allied with mecopterous larvae than with those of the Trichoptera.

COLEOPTERA. Since larvae of this order frequently resemble those of the Lepidoptera, it is interesting to compare the antennae of the two. As there is such a diversity of form in coleopterous antennae, it is impossible to discuss every type here (cf. Böving and Craighead, 1931). Suffice it to say that there are extremely reduced types as found in *Geraeus penicellus* Herbst., some superficially resembling those of lepidopterous larvae such as *Limnius troglodytes* Gyll., *Nosodendron unicolor* Say, *Byrrhus fasciatus* Forst., *Anaspis* sp., and *Byturus tomentosus* F., and some very long, conspicuous, many segmented such as *Cucujus clavipes* F., *Ochtebius impressus* Marsh., *Hydaticus transversalis* Pontopp., *Clinidium sculptile* Newn., and *Prionocyphon discoideus* Say. The segmentation is bizarre and difficult. Usually present are an antacoria and antennaria. Antennal muscles insert on the base of the first segment. Among the sensilla present are sensilla campaniformia, sensilla basiconica, and sensilla trichodea. The last occur in the greatest numbers. The sensilla basiconica are in the majority of cases quite distinct from those of the Lepidoptera.

HYMENOPTERA. In this order the greatest antennal development occurs in the Tenthredinoidea. Not only is there a difference in size and number of segments but also in the position of the organ (Yuasa, 1922). Diversity is almost but not quite so great as in the Coleoptera. An antennaria and antacoria are universally present. There may be from one to seven segments, and segmentation may be complete or incomplete. The best that may be said for the uniformity of the antennae is that the number of segments is constant for a subfamily. They are remarkable for their streamline and terraced effect. Although some bear sensilla, the vast majority are apparently free from external sensilla of any kind. Middleton (1922) divided the antennae of sawfly larvae into three types. There is a telescopic type with five to seven joints, a cone and disk type, and a type with disks alone.

It is quite obvious that the Coleoptera and Hymenoptera are highly specialized groups having no connection with the Lepidoptera in spite of the similarity of larvae. Here again it is well to point out that the antennae afford an excellent means of separating the larvae of the three orders.

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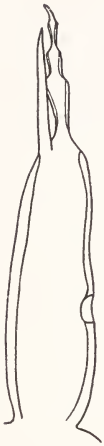
EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 6. Antenna of *Chironomus* larva. (x325).
Fig. 7. Antenna of *Myrmeleon* larva. (x75.8).
Fig. 8. Antenna of *Chironomus* larva. (x780).
Fig. 9. Antenna of *Pulex serraticeps*. (x780).
Fig. 10. Antenna of Cerambycid larva. (x325).



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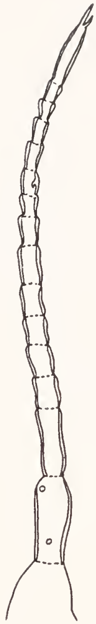

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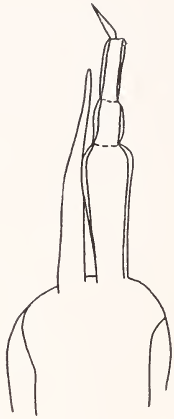

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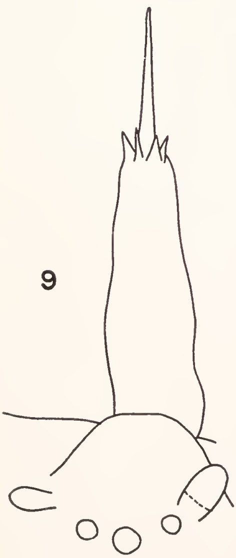

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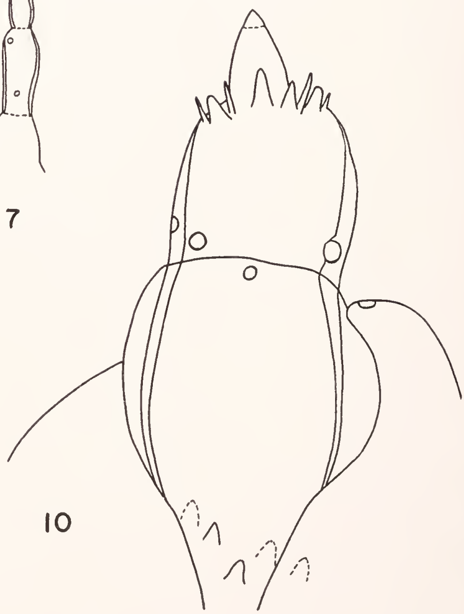

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PLATE 2

PLATE 2

Fig. 11. Distal end of the antenna of *Pieris rapae* L. (x325).
Fig. 12. Antenna of *Neophasia menapia* F. & F. (x75.8).
Fig. 13. Third segment of the antenna of *Nymphalis antiopa* L. showing supernumerary sensilla. (x325).
Fig. 14. Distal end of the antenna of *Basilarchia archippus* Cram. (x325).
Fig. 15. Third segment of the antenna of *Morpho laertes* Druce. (x325).
Fig. 16. Distal end of the antenna of *N. antiopa* L. (x325).
Fig. 17. Third segment of the antenna of *Papilio philenor* L. (x325).
Fig. 18. Distal end of the antenna of *P. philenor* L. (x325).
Fig. 19. Distal end of the antenna of *Papilio glaucus* form *turnus* L. (x325).
Fig. 20. Antenna of *P. philenor* L. (x75.8).
Fig. 21. Distal end of the antenna of *Colias philodice* Godt. (x325).
Fig. 22. Antenna of *Megisto eurytus* Fabr. (x75.8).
Fig. 23. Distal end of the antenna of *Danaus plexippus* L. (x325).


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PLATE 3

PLATE 3

Fig. 24. Antenna of *P. glaucus* form *turnus* L. (x75.8).
Fig. 25. Antenna of *Basilarchia archippus* Cram. (x75.8).
Fig. 26. Antenna of *Danaus berenice* Cram. (x75.8).
Fig. 27. Antenna of *P. rapae* L. (x75.8).
Fig. 28. Distal end of the antenna of *Everes comyntas* Godt. (x325).
Fig. 29. Antenna of *Pieris brassicae* L. (x75.8).
Fig. 30. Antenna of *Danaus plexippus* L. (x75.8).
Fig. 31. Antenna of *Papilio ajax* L. (x75.8).
Fig. 32. Distal end of the antenna of *Neonympha gemma* Hbn. (x325).
Fig. 33. Terminal segments of the antenna of *Coenonympha tullia* Hbn. (x325).
Fig. 34. Third segment of the antenna of *Appias ilaire* Godt. (x325).
Fig. 35. Distal end of the antenna of *Megisto hermes* form *sosybius* Fabr. (x325)
Fig. 36. Antenna of *N. antiopa* L. (x75.8).
Fig. 37. Distal end of the antenna of *P. ajax* L. (x325).
Fig. 38. Antenna of first instar *Argynnis cybele* Fabr. (x780).
Fig. 39. Distal end of the antenna of *P. brassicae* L. (x325).
Fig. 40. Distal end of the antenna of *N. menapia* F. & F. showing supernumerary sensilla basiconica. (x325).
Fig. 41. Distal end of the antenna of first instar *Brenthis myrina* Cram. (x780).
Fig. 42. Distal end of the antenna of *Vanessa atalanta* L. (x325).

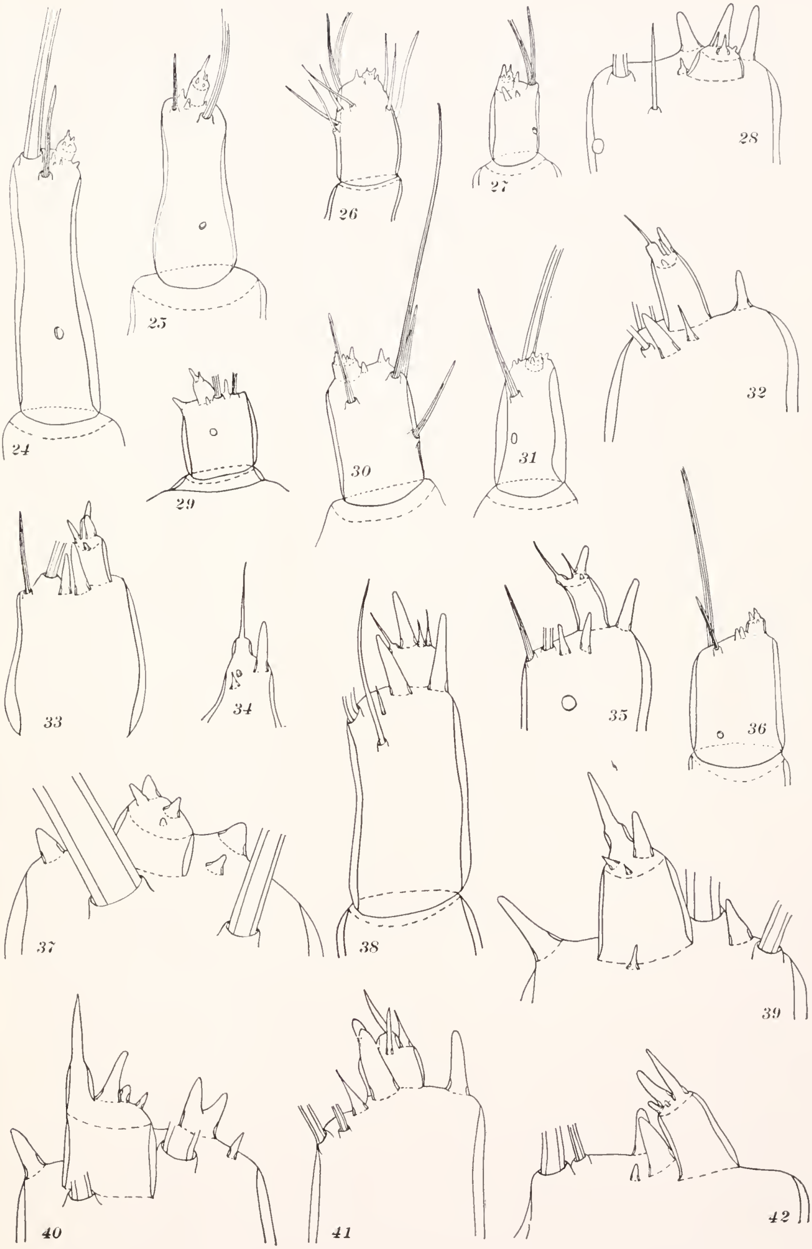
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PLATE 4

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Fig. 43. Antenna of second instar *Calpodes ethlius* Cram. (x75.8).
Fig. 44. Antenna of third instar *C. ethlius* Cram. (x75.8).
Fig. 45. Sensillum styloconicum of *Vanessa virginiensis* Dru. (x780).
Fig. 46. Distal end of the antenna of *Ancyloxypha numitor* Fabr. (x780).
Fig. 47. Antenna of *A. ilaire* Godt. (x75.8).
Fig. 48. Antenna of first instar *Platysamia cecropia* L. (x75.8).
Fig. 49. Antenna of fifth instar *C. ethlius* Cram. (x75.8).
Fig. 50. Antenna of fourth instar *C. ethlius* Cram. (x75.8).
Fig. 51. Antenna of *Callosamia promethea* Dr. (x75.8).
Fig. 52. Antenna of third instar *P. cecropia* L. (x75.8).
Fig. 53. Antenna of first instar *C. ethlius* Cram. (x75.8).
Fig. 54. Distal end of the antenna of fifth instar *P. cecropia* L. (x75.8).
Fig. 55. Antenna of *Thorybes pylades* Scud. (x75.8).
Fig. 56. Antenna of second instar *P. cecropia* L. (x75.8).
Fig. 57. Distal end of the antenna of fifth instar *C. ethlius* Cram. (x325).
Fig. 58. Distal end of the antenna of last instar *P. cecropia* L. (x325).
Fig. 59. Distal end of the antenna of *T. pylades* Scud. (x325).
Fig. 60. Antenna of *Polites themistocles* Latr. (x780).
Fig. 61. Antenna of *Poanes hobomok* Harr. (x780).
Fig. 62. Antenna of *Catia otho* A. & S. (x780).

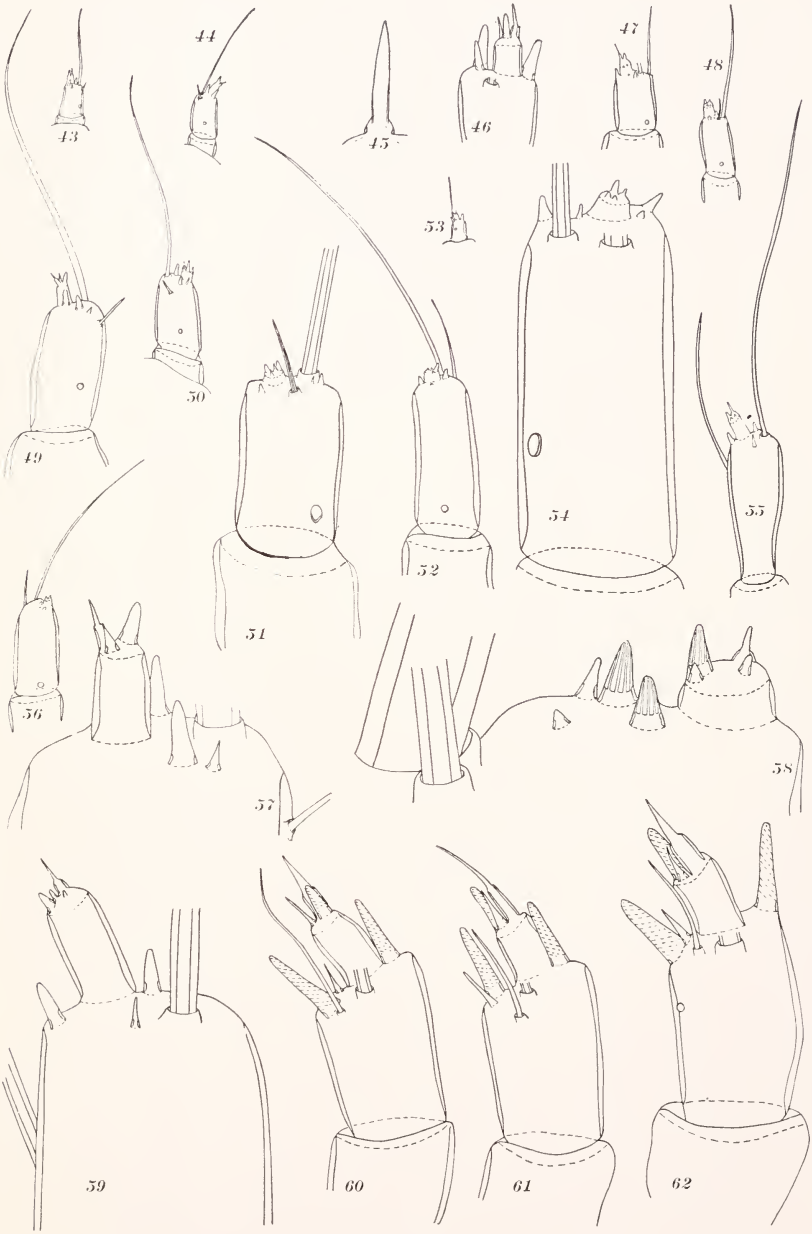
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PLATE 5

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Fig. 63. Antenna of early instar *Autographa* sp? (x325).
Fig. 64. Antenna of *Xanthopastis timais* Cram. (x75.8).
Fig. 65. Antenna of first instar *Ceratomia catalpae* Bdv. (x75.8).
Fig. 66. Antenna of *Cucullia convexipennis* G. & R. (x75.8).
Fig. 67. Antenna of *Rhodophora florida* Gn. (x75.8).
Fig. 68. Distal end of the antenna of *Apamea velata* Wlk. (x325).
Fig. 69. Distal end of the antenna of *Achatodes zeae* Harr. showing supernumerary sensilla basiconica (x325).
Fig. 70. Distal end of the antenna of *Anisota virginiensis* Dru. (x325).
Fig. 71. Antenna of last instar *C. catalpae* Bdv. (x75.8).
Fig. 72. Distal end of the antenna of a phalaenid. (x325).
Fig. 73. Distal end of the antenna of *Alypia octomaculata* Fabr. (x325).
Fig. 74. Distal end of the antenna of *Lycaenopsis pseudargiolus* Bdv. & Lec. (x325).
Fig. 75. Distal end of the antenna of *Euchaetias egle* Dru. (x325).
Fig. 76. Distal end of the antenna of *Leucania pseudargyria* Gn. (x325).
Fig. 77. Distal end of the antenna of *Phlegethontius quinquemaculata* Haw. (x325).
Fig. 78. Distal end of the antenna of *Syntomya thega* L. (x325).
Fig. 79. Distal end of the antenna of *C. promethea* Dru. (x325).

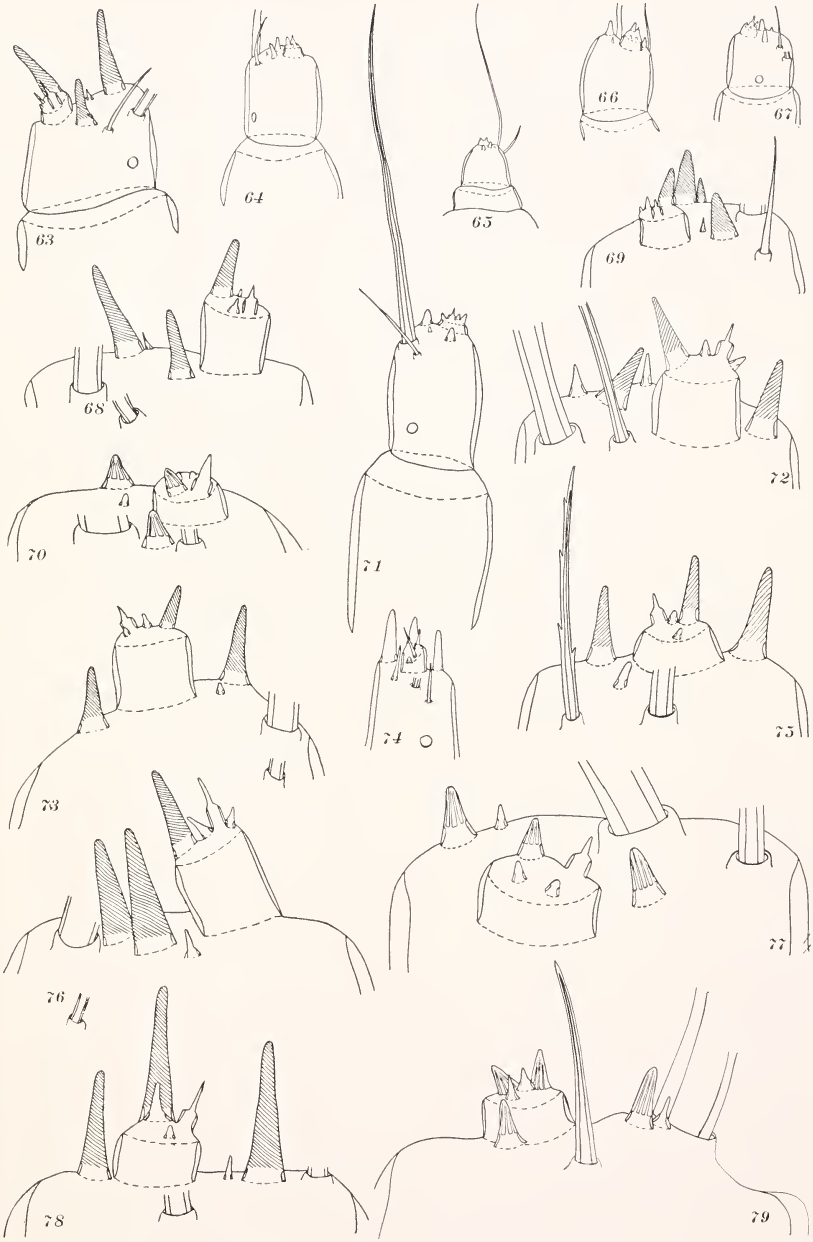
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PLATE 6

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Fig. 80. Distal end of the antenna of *Schizura concinna* A. & S. (x325).
Fig. 81. Antenna of *Schizura ipomoeae* Dbldy. (x75.8).
Fig. 82. Antenna of *Ceramica picta* Harr. (x75.8).
Fig. 83. Distal end of the antenna of *C. picta* Harr. showing supernumerary sensilla basiconica. (x325).
Fig. 84. Distal end of the antenna of *S. ipomoeae* Dbldy. showing supernumerary sensilla on segment three. (x325).
Fig. 85. Antenna of *S. concinna* A. & S. (x75.8).
Fig. 86. Distal end of the antenna of undetermined sphingid showing peculiar sculpturing of the sensilla basiconica. (x325).
Fig. 87. Distal end of the antenna of *Isia isabella* A. & S. (x325).
Fig. 88. Distal end of the antenna of *Estigmene acrea* Dru. (x325).
Fig. 89. Antenna of *Oxyptilus periscelidactylus* Fitch. (x325).
Fig. 90. Antenna of *Nymphula maculalis* Clem. (x75.8).
Fig. 91. Distal end of the antenna of *Prodoxus quinquepunctellus* Cham. (x325).
Fig. 92. Antenna of *E. acrea* Dru. (x75.8).
Fig. 93. Distal end of the antenna of *N. maculalis* Clem. (x325).
Fig. 94. Distal end of the antenna of *Pyralis farinalis* L. (x325).
Fig. 95. Distal end of the antenna of *Malacosoma americanum* Fabr. (x325).
Fig. 96. Distal end of the antenna of *Cingilia catenaria* Dru. (x325).
Fig. 97. Distal end of the antenna of *Pyrausta nubilalis* Hbn. (x325).

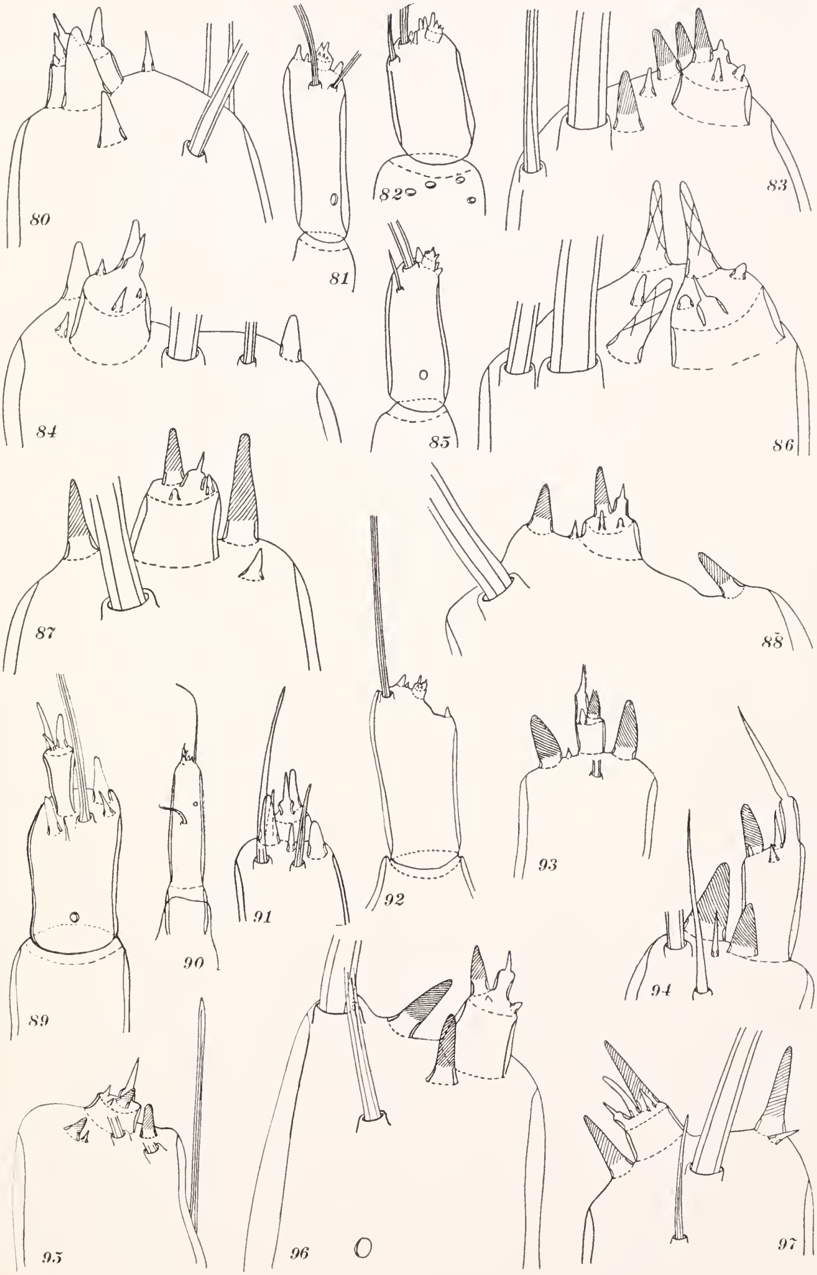
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PLATE 7

PLATE 7

Fig. 98. Distal end of the antenna of *Hyperaeschra stragula* Grt. (x75.8).
Fig. 99. Antenna of *Heterocampa bilineata* Pack. (x75.8).
Fig. 100. Antenna of *Heterocampa biundata* Wlk. (x75.8).
Fig. 101. Antenna of *Rivula propinqualis* Gn. (x75.8).
Fig. 102. Antenna of *Acronicta americana* Harr. (x75.8).
Fig. 103. Antenna of *Catocola relicta* Wlk. (x75.8).
Fig. 104. Antenna of *Datana perspicua* G. & R. (x75.8).
Fig. 105. Antenna of *Pyrrhia umbra* race *exprimens* Wlk. (x75.8).
Fig. 106. Distal end of the antenna of *Olene achatina* A. & S. (x75.8).
Fig. 107. Antenna of *Peridroma margaritosa* form *saucia* Hbn. (x75.8).
Fig. 108. Antenna of *Symmerista albifrons* A. & S. (x75.8).
Fig. 109. Distal end of the antenna of *Raphia frater* Grt. (x325).
Fig. 110. Distal end of the antenna of *Hadena basilinea* (x325).
Fig. 111. Distal end of the antenna of an undetermined tortricid. (x325).
Fig. 112. Distal end of the antenna of an undetermined geometrid showing supernumerary sensilla on segment three. (x325).
Fig. 113. Antenna of *Lagoa crispata* Pack. (x75.8).
Fig. 114. Antenna of *Parasa chloris* H.S. (x75.8).
Fig. 115. Distal end of the antenna of an undetermined geometrid (x325).
Fig. 116. Antenna of *Malacosoma disstria* Hbn. (x75.8).
Fig. 117. Distal end of the antenna of *Pseudoterpna pruniata* Hufn. (x325).
Fig. 118. Distal end of the antenna of *Megalopyge opercularis* A. & S. (x325)
Fig. 119. Antenna of *Cossus ligniperda* Fabr. (x75.8).
Fig. 120. Distal end of the antenna of an undetermined geometrid (x325).

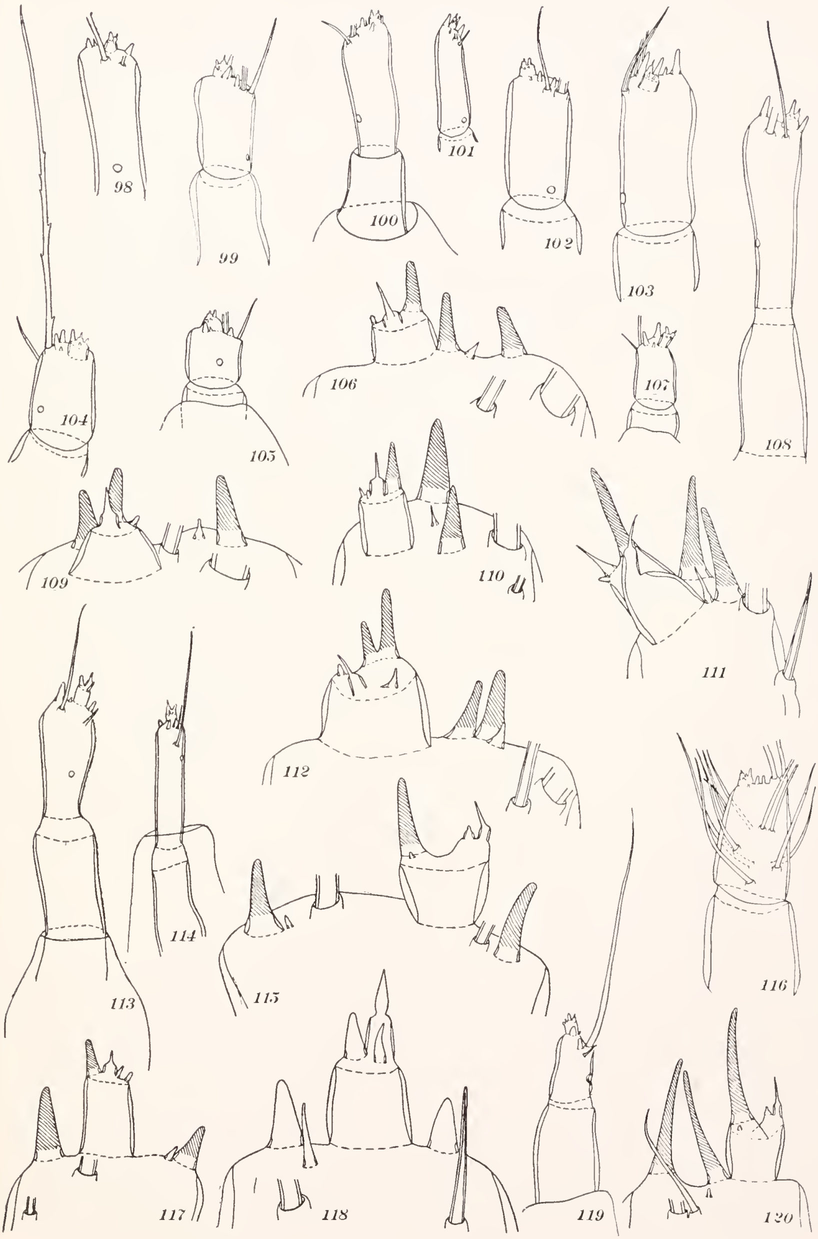
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PLATE 8

PLATE 8

Fig. 121. Antenna of *Lithocolletis* sp. (x780).
Fig. 122. Antenna of *Lithocolletis* sp. (x780).
Fig. 123. Antenna of *Tortricidia* sp. (x325).
Fig. 124. Antenna of *Lithocolletis* sp. (x780).
Fig. 125. Antenna of *Phyllocnistis* sp. (x780).
Fig. 126. Antenna of *Nepticula* sp. (x780).
Fig. 127. Antenna of an undetermined aegeriid. (x75.8).
Fig. 128. Distal end of the antenna of *Oiketicus abboti* Grt. (x325).
Fig. 129. Anomalies on segment two of *Acrolepia cariosella* (x780).
Fig. 130. Antenna of *Laspeyresia nigricana* Steph. (x75.8).
Fig. 131. Antenna of *Lithocolletis* sp. (x780).
Fig. 132. Third segment of the antenna of an undetermined geometrid. (x325).
Fig. 133. Antenna of *O. abboti* Grt. (x75.8).
Fig. 134. Antenna of *Lithocolletis robiniella* Clem. (x780).
Fig. 135. Distal end of the antenna of *Phobetron pithecium* A. & S. (x325).
Fig. 136. Antenna of *Lithocolletis* sp. (x780).
Fig. 137. Distal end of the antenna of *Sparganothis pilleriana* Schiff. (x325).
Fig. 138. Antenna of an undetermined geometrid. (x75.8).
Fig. 139. Distal end of the antenna of an undetermined tortricid showing supernumerary sensilla basiconica. (x325).
Fig. 140. Antenna of an undetermined aegeriid. (x325).
Fig. 141. Distal end of the antenna of *Solenobia pineti* (x325).
Fig. 142. Distal end of the antenna of tortricid. (x325).
Fig. 143. Distal end of the antenna of *Eucosma foenella* L. (x325).
Fig. 144. Antenna of *Synanthedon exitiosa* Say. (x75.8).
Fig. 145. Antenna of *Bembecia marginata* Harr. (x75.8).
Fig. 146. Distal end of the antenna of *Apatelodes angelica* Grt. (x325).
Fig. 147. Antenna of *Alcathoe apiformis* Clerck. (x75.8).
Fig. 148. Antenna of *A. angelica* Grt. (x75.8).

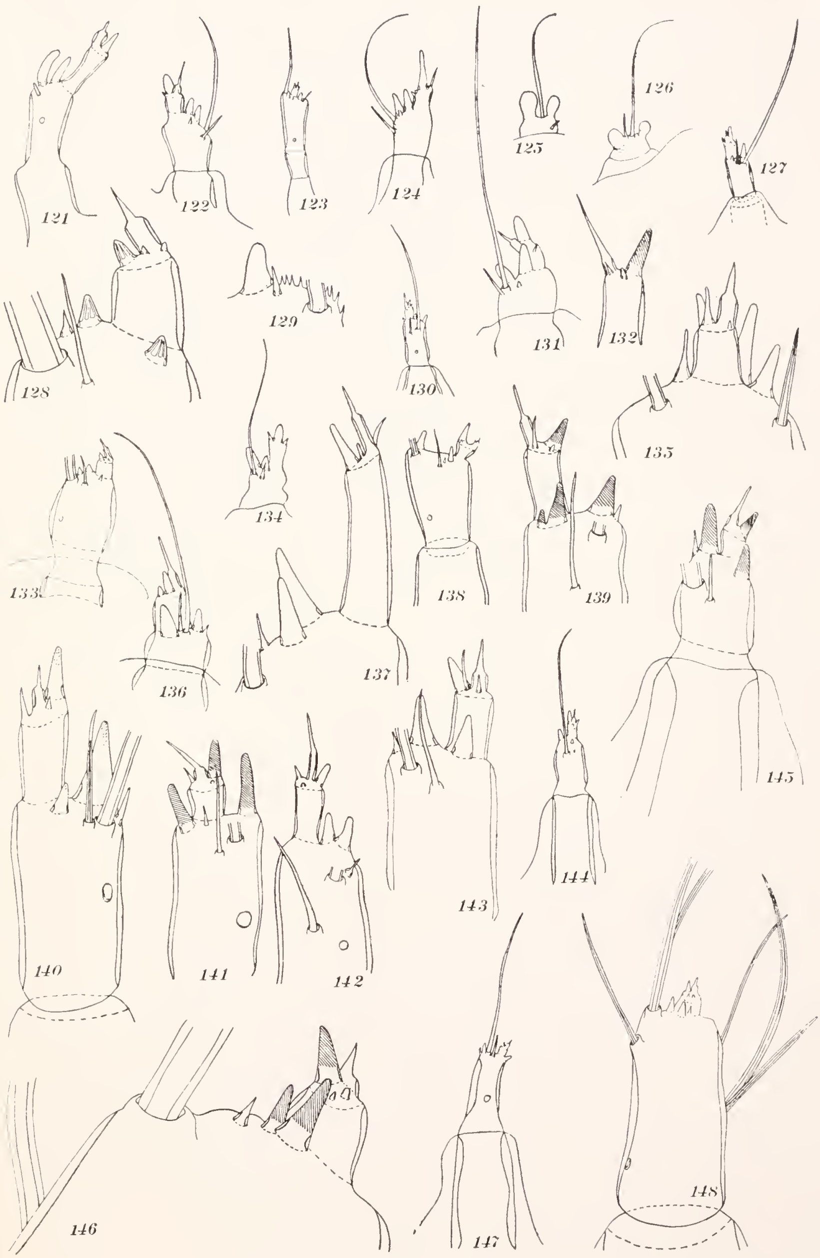
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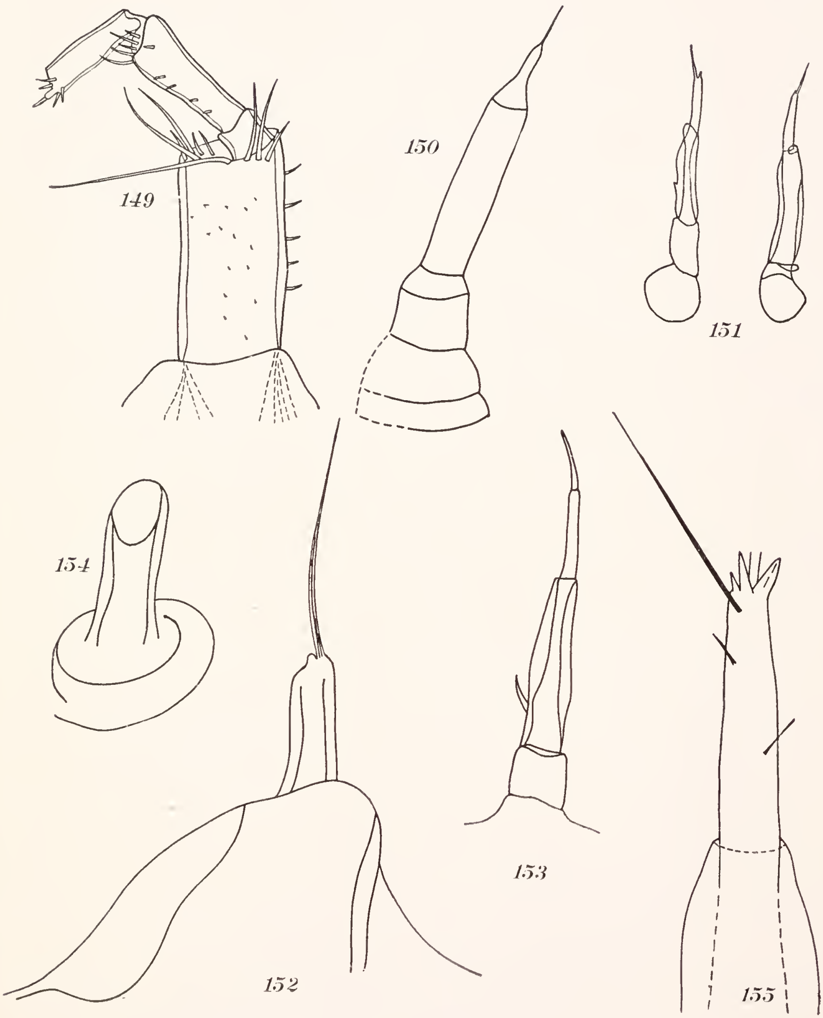
PLATE 9

PLATE 9

Fig. 149. Antenna of *Inocellia* sp? (x75.8).
Fig. 150. Antenna of *Sabatinca barbarica* Philp. (from Tillyard).
Fig. 151. Antennae of *Eriocephala calthella* L. (from Chapman).
Fig. 152. Antenna of *Agraylea multipuncta* Curt. (Trichoptera) (x75.8).
Fig. 153. Antenna of *E. calthella* L. (from Packard).
Fig. 154. Antenna of an undetermined limnophilid. (Trichoptera) (x325).
Fig. 155. Antenna of *Nymphula maculalis* Clem. (from Forbes).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Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
Vol. LXXXVII, No. 7

NOTES ON THE SNAKE GENUS ANOMALEPIS

By Emmett Reid Dunn

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March, 1941

No. 7. — *Notes on the Snake Genus Anomalepis.*[1]

By Emmett Reid Dunn

The only information about the snake genus Anomalepis that comes from writers who have actually seen examples of the genus has been put out by six men and is to be found in the following papers:

Jan and Sordelli, 1860 (Icon. Gen. Ophid., Livr. 1, pl. 5, fig. 1; pl. 6, fig. 1a, 1b, 1e, 1g, 1p, 1r, 1v, 1x, 1z).

Jan, 1861a (Arch. f. Naturg., **27**, no. 1, p. 6).

Jan, 1861b (Arch. Zool., L'Anat. Fis., **1**, no. 2, p. 185).

Jan, 1863 (Elenco Sist. Ofid., p. 9).

Jan, 1864 (Icon. Gen. Ophid., Les Typhlopiens, p. 6–7).

Dunn, 1923 (Proc. Biol. Soc. Washington, **36**, p. 185–186).

Amaral, 1927 (Bull. Antivenin Inst. Amer., **1**, no. 3, p. 88–89, figs. 1–2).

Essex, 1927 (Proc. Zool. Soc. London, p. 921–923).

Dunn, 1932 (Proc. Biol. Soc. Washington, **45**, p. 175).

Taylor, 1939 (Proc. New England Zool. Club, **17**, p. 87–96, pl. 5, figs. 1–9).

Others have mentioned the genus without examining specimens, and the remarks of only Peters and Boulenger are of importance. Peters (1862, Arch. f. Naturg, **28**, no. 1, p. 42–43) called attention to discrepancies between the dorsal (pl. 6, fig. 1a) and the lateral (pl. 6, fig. 1e) figures of the type specimen, and pointed out similar discrepancies in the figures of four other species on the same plate as inherent evidence of inaccuracy. Boulenger (1893, Cat. Snakes Brit. Mus. Nat. Hist., ed. 2, **1**, p. 59) used the feminine *mexicana* instead of the original masculine *mexicanus* for the type species, in which error he was followed by Dunn, by Amaral, and by Essex.

The material basis for these papers amounts to no more than thirteen snakes, which were collected by six men.

The original specimen of *Anomalepis mexicanus* Jan and Sordelli was said by them to have come from "Mexico", and to be in the Milan Museum. They do not give the collector's name, the date of the collection, or any definite locality. No one else has claimed to have examined this specimen. Thirty-three years after its description, Günther (1893, Biol. Cent.-Amer., Rept., p. 87) says "the statement as to the origin of this species requires confirmation." Forty-seven additional years have failed to produce the required confirmation.

[1] Contributions from the Department of Biology, Haverford College, No. 50.

G. K. Noble took eight specimens of Anomalepis at Perico, Peru, in 1916. Since his Peruvian collection also contained the first additional specimens of *Leptognathus vagus* Jan and Sordelli, described from a Milan Museum specimen labeled "Hongkong", it seemed legitimate to infer that Peru might have been the real source of the Milan Anomalepis. Three of Noble's specimens (MCZ 17401–3) were examined and reported on by me and later by Amaral. The first of these has recently been examined by Taylor and again by me. The second is in the British Museum and the third is in the Senckenberg Museum. There were five others (MCZ 14781–5) which neither I nor Amaral found. MCZ 14784 was loaned to Essex and is the basis for his remarks. It was then sent to the National Museum (where it is No. 76295), and was examined there by Taylor, who later examined the other four in Cambridge. I have recently examined MCZ 14781, 14783, and 14785, the last in a stained and cleared condition.

W. C. Allee took one at Frijoles, Panama Canal Zone, in 1924. This is in the Field Museum, and has been examined by Amaral and by Taylor.

I took one on Barro Colorado Island, Panama Canal Zone, in 1930. This is now MCZ 29220, and has been examined by Taylor and by me. Taylor (p. 90) says that this specimen was collected by James Zetek, but this is incorrect.

A. E. Emerson took one on Barro Colorado Island in 1935. This is in the Field Museum and has been examined by Taylor.

K. W. Cooper took one on Barro Colorado Island in 1937. This is in Rochester and has been examined by Taylor.

As I seem to have been the only person to have both collected and published on Anomalepis, and since I have been working on a Herpetology of Panama for over ten years, I am compelled to give critical attention to Taylor's recent paper, and begin by outlining the recent systematic treatments of these snakes.

In 1923 I regarded three Peruvian snakes as specimens of *Anomalepis mexicanus* Jan and Sordelli, although I noted that they differed from the original in number of scale rows, and in details of head scalation.

In 1927 Amaral, who had, in addition, a Panamanian specimen, noted the head scale differences and suggested that they might be due to inaccuracies in the original figures. He noted that the Panamanian specimen agreed with the original in number of scale rows, whereas the Peruvians differed, and suggested that, with more material, two forms might eventually be recognized.

In 1939 Taylor examined six Peruvian and four Panamanian speci-

mens. The scale row differences noted by Amaral were found to hold good for the new material. The longitudinal scale count provided another means of differentiating Peruvian from Panamanian Anomalepis (this latter character is not known for the original Milan specimen). Amaral's suggestion was followed, and the Peruvian and Panamanian forms were considered different species. As the Peruvian form differs from the Milan specimen in scale rows, it received a new name. At the same time Taylor named the Panamanian form as a new species, an action which will have to be examined. He proposed a new family of snakes for the genus, which action also demands consideration.

Taylor's paper contains a number of incorrect references to previous work. I here correct only the more important of these, although I have noted at least eight others. I shall then criticize his grounds for describing the Panamanian specimens as a different species from *mexicanus*, and his grounds for erecting a family Anomalepidae. Finally, I am enabled, through the kindness of Dr. Barbour and of Dr. Zangerl, to make some definitive statements as to the osteology of the Peruvian form, and to compare and contrast it with the skeletal structures of Typhlopidae and Leptotyphlopidae as made known in a number of recent papers. Comments, in the order given above, follow:

1. The author and date of the generic name is given in the first sentence of Taylor's paper as "Jan (1861)". This is incorrect. The generic name Anomalepis, accompanied by a single specific name (*mexicanus*), and illustrated by ten figures, was published in December 1860, by joint authors whose names appear as Georges Jan and Ferdinand Sordelli.

2. On p. 93 Taylor states that the "type description" of the species *mexicanus* is by Jan and is to be found in "Arch. f. Nat., **27**, 1861, p. 66". This is incorrect. The correct citation for the specific name is the same as that for the generic. There is nothing at all by Jan on p. 66 of the volume cited. Jan states on p. 6 of this volume that Anomalepis, Typhlops, Idiotyphlops, and Cephalolepis, "bloss Zähne im Oberkiefer haben", but no specific name is given.

3. Taylor states (p. 93) that the combination *Anomalepis mexicanus* occurs in "Jan..........Arch. Anat. Zool. Phys., **1**, 1862, p. 185". This is incorrect. Search in the library of the Philadelphia Academy and in the records of periodical literature (aided by the librarian, Mr. Fox), fails to indicate that any such journal was ever published. It is possible that there may have been an attempt to refer to the "Archivio per la Zoologia L'Anatomia e la Fisiologia", vol. 1, no. 2, p. 185, which

appeared in December 1861. Here there is a reference to the genus Anomalepis by Jan, but no specific name is given.

4. Taylor (p. 94) states that the combination *Anomalepis mexicanus* occurs in "Amaral, Proc. Biol. Soc. Washington, **39**, pp. 123–126". This is incorrect. The paper referred to is about *Helminthophis flavoterminatus* and there is no reference at all to Anomalepis.

5. Taylor (p. 89) says that in examining a Peruvian Anomalepis (USNM 76295) he found differences from "the figures of *Anomalepis mexicanus* published by Jan and Sordelli (1860) as well as from the figure given by Amaral (1927)", and "several . . . significant characters that were in neither figure." This is incorrect. If he means Amaral's figure 1, it is incorrect to say that it is "given" by Amaral, or to use the phrase "neither figure", because Amaral's figure 1 is a copy of Jan and Sordelli 1860, pl. 6, fig. 1e, and stated to be a copy by Amaral. If he means Amaral's figure 2 (drawn from a Peruvian specimen, one of the lot MCZ 17401–3) it is incorrect to state that he found more than one character not in it. Taylor mentions three characters, the two last being "separating the nasals from the labial border was a vertically elongate labial. This was followed behind by three other labials." These two characters appear plainly in Amaral's second figure and are thoroughly discussed in his text.

6. Taylor's figure 8 purports to be a figure of the dorsal surface of the head of the type of *mexicanus* (Jan and Sordelli, pl. 6, fig. 1a). It is a copy of a copy and is incorrect. In his figure three equal scales, symmetrically arranged, border the frontal posteriorly. In the original figure two scales only are shown, and the one on the right is double the size of that on the left.

7. Taylor's figure 9 purports to be a figure of the lateral surface of the head of the type of *mexicanus* (Jan and Sordelli, pl. 6, fig. 1e). It is a copy of a copy and is incorrect. In his figure the ocular extends further back than the supraocular. In the original the supraocular extends further back than the ocular, "nach hinten weit überragenden" says Peters (1862).

8. Taylor (pl. 5, fig. 4) gives a figure of the left side of the head of USNM 76295 from Perico, Peru, and (pl. 5, fig. 6) a dorsal view of the head of the same specimen. One of these figures must be incorrect because the two are not consistent. The lateral view shows the ocular extending back further than the supraocular; the ocular-upper preocular contact is very narrow. The dorsal view shows the supraocular extending for about half its length posterior to the ocular, the ocular contact with the upper preocular is four times as long as in the lateral

view and entirely different in nature. This is the same sort of inconsistency that Peters noted between the dorsal and lateral views of the head of the type of *mexicanus,* and he remarked that it was "ganz unmöglich" to reconcile them as being of the same snake. This is only to indicate that even the most recent and best figures of these snakes may be incorrect.

9. Taylor (p. 89) says that Peters' criticism of fig. 1a (top of head) and 1e (side of head) in Jan and Sordelli is "a rather negligible point concerning an angle on one scale". This is incorrect. Taylor quotes Peters' remarks (in German), and to anyone who can read German it will be obvious that Taylor has given (in English) a false impression. What Peters is really calling attention to is not an angle on one scale at all, but that in the dorsal view the ocular extends much further back than the supraocular, while in the lateral view the reverse is the case. If the two figures are from the same specimen one must postulate that one or the other is incorrect.

10. Taylor (p. 89) says that the head scales of the Peruvian and Panamanian Anomalepis differ from those of the Jan and Sordelli figures of *Anomalepis mexicanus* "so remarkably that they could not possibly be regarded as the same species, save by postulating that the figure by Sordelli was wholly incorrect", and (p. 94) that *mexicanus* differs so much from "the species herein described that there may be some doubt that they are generically identical". This is gross exaggeration. The Jan and Sordelli figures of *mexicanus* agree scale by scale and contact by contact with Taylor's figures of his *dentatus* and *aspinosus* except for the area around the nostril and the area back of the third upper labial and the second postfrontal.

In the region of the nostril Taylor figures two short sutures running anteriorly from the nostril to the rostral. Jan and Sordelli do not show these and thus have a single large nasal (semi-divided by a suture from nostril to loreal) in a region where Taylor shows an upper and a lower nasal and a first upper labial. As the situation figured by Jan and Sordelli is unique, whereas that figured by Taylor is common to Helminthophis, Liotyphlops and most Typhlops, there is *a priori* ground for the inference that Jan and Sordelli missed these two prenostril sutures. Further ground for such an inference is to be found in the criticisms of Peters, and in the admission of Jan himself (1864, p. 32) that the figures of at least one species (*Idiotyphlops flavoterminatus*) on pl. 6 were inaccurate. This inference is strengthened by the fact that I, in 1923, did not observe the upper of these sutures (although I have since verified its presence), nor did Amaral observe it in 1927, although

"working carefully . . . under the microscope with strong magnification." I observed the lower of these sutures in 1923, and so did Amaral in 1927, although, as he says, "it is very difficult to discover" and "extends almost imperceptibly . . . to the border of the rostral." It is surely legitimate to infer that Jan and Sordelli did not work with electric light and a modern binocular microscope.

Back of the large third upper labial and the second postfrontal the head scales become scarcely distinguishable from those of the body. In this region Jan and Sordelli did not distinguish a fourth upper labial nor did I in 1923. Amaral called attention to this scale in 1927, speaking of it as "a small and narrow shield, lying right in the corner of the mouth" and as "very small." Jan and Sordelli actually figure a scale just behind the third upper labial, and this has all the scale contacts of the fourth upper labial, but it is not represented as forming part of the border of the mouth.

Upon considering the above facts, and realizing that without examining the type of *maxicanus* some inference is absolutely unavoidable, I prefer the inference made by Amaral and myself to that made by Taylor. We infer that the original figures contain some errors and some omissions, although they are still very good diagrammatic representations of the conditions to be found in either the Panamanian or the Peruvian form. Taylor infers that the original figures are correct in detail.

Under these circumstances Taylor is, in my opinion, quite unjust to my distinguished Brazilian colleague when he says (p. 89) "Amaral (1927) in commenting on the differences believes that the figure is not correctly drawn (presumably because it did not agree with the specimens he had)." I should not like to suggest that Taylor believed that the figures were correctly drawn (presumably because they did not agree with the specimens he had) and thus was enabled to describe a new species.

11. The Panamanian snakes are fully described by Taylor, and their differences from the Peruvian form sufficiently noted, but there is nothing in diagnosis or in description given, whereby to differentiate the Panamanian *A. dentatus* Taylor from *mexicanus*. The student is left to infer these differences from the descriptions. I have noted the following supposed differences:

a. Presence of two sutures anterior to the nostril in *dentatus* and their absence in the figures of *mexicanus*. I have already given my reasons for believing this difference imaginary.

b. Presence of a small fourth upper labial in the Panamanian form

and its absence, as such, in the figure of *mexicanus*. I have already given my reasons for believing this difference imaginary.

c. The supraocular of the Panamanian form is proportionately larger than that shown in either figure of *mexicanus*. But attention has already been called to the fact that this scale is certainly represented inaccurately in one of the figures, and maybe in both.

d. Taylor (p. 94) says "the figure given by Jan shows a projection on the terminal caudal plate. There is no suggestion of a terminal spine in the two species herein described." Jan and Sordelli give three figures of the tail of *mexicanus*. That of the entire snake (pl. 5, fig. 1) shows a distinct spine. The much more enlarged figures of the tail alone (pl. 6, fig. 1x and 1z), while not in agreement with each other on this point, both show a much less distinct spine. Obviously two of the three figures are incorrect.

e. The "Mexican" provenance of the Milan type lacks confirmation, and in any event is no grounds for specific separation. Mexico and Panama have a number of snake species in common.

Until the type is examined and found to differ from Panamanian specimens, or until material from elsewhere is found to agree better with the description of *mexicanus* than do the Panamanian specimens, I shall consider *Anomalepis dentatus* Taylor as a synonym of *A. mexicanus* Jan and Sordelli. To do otherwise would mean disregarding the generally accepted principle of Occam's razor (that entities are not to be unnecessarily multiplied).

Even should the type of *mexicanus* prove to have a slightly smaller supraocular and a vestige of a caudal spine, the division of a set of five specimens into two species on this slim basis would seem to me unwarrantable.

12. Jan (1861b), Dunn (1923) and Amaral (1927) observed teeth on the upper jaw and did not observe teeth on the lower jaw in the specimens available to them. Taylor found teeth in the lower jaw of USNM 76295 (a Peruvian specimen not studied by me or by Amaral), and includes the phrase "teeth in both jaws" in the diagnosis of his Panamanian species. In the four Peruvian and one Panamanian specimen I have recently examined, teeth on the upper jaw, transversely arranged as in Typhlops, are plainly visible in all. I can neither affirm nor deny presence or absence of teeth in the lower jaw of three of the Peruvian specimens (MCZ 14701, which is the only available specimen seen by me in 1923 and by Amaral in 1927; MCZ 14781, MCZ 14783), after examination under a binocular microscope with electric illumination, but using due regard for the specimens. A single

tooth is present on the tip of the dentary in MCZ 14785 from Peru, a stained and cleared specimen. A single tooth on each lower jaw is easily visible in MCZ 29220 from Barro Colorado Island. Thus teeth on the lower jaw cannot be found (if the same methods are employed) in three out of four specimens of Anomalepis.

Leptotyphlops has a row of teeth on each lower jaw. These are transversely oriented and are obvious to the most casual examination. Leptotyphlops has no teeth on the upper jaw.

13. Taylor concludes by naming Anomalepis as the monotypic genus of a new family of snakes, concerning which he says: "this small group of snakes associated in the genus Anomalepis differs from both the families Typhlopidae and Leptotyphlopidae in such a way as to preclude their inclusion in either family. Did they have the same cephalic squamation, one might regard them as a connecting link between the Leptotyphlopidae and the Typhlopidae, reducing each to subfamily status. However, the squamation of the head is so very different that it may be considered unique in serpents."

This passage would seem to imply that the families Typhlopidae and Leptotyphlopidae differ only in dentition, but all serious students of snakes know that this is only a "key" character, and that it is accompanied by profound differences in the skeleton and musculature of the mechanisms of the jaws. Even a superficial examination indicates that Anomalepis is like Typhlops in this respect and unlike Leptotyphlops.

The passage would also seem to imply that a snake could have "the same cephalic squamation" as the Typhlopidae and the Leptotyphlopidae. All serious students of snakes will recognize this as perfectly impossible. The most casual examination shows that the cephalic squamation of Anomalepis is far more like that of Typhlops than Leptotyphlops. There are a great many snake genera whose cephalic squamation is "unique," and the Typhlopidae have always been arranged into genera, each with its own "unique" cephalic squamation.

The "cephalic squamation" of Anomalepis is very similar to that of the "normal" snake. Every scale of the Anomalepis head may be identified scale by scale and contact by contact with those of Helminthophis, except for the loreal, the position of which, in Helminthophis, is occupied by a posterior production of the upper nasal, so that it is practically certain that a fusion of the two has occurred. The rostral is larger in Helminthophis and still larger in Liotyphlops, in which genus it makes contact with the frontal and separates the prefrontals in the median line. In Typhlops the prefrontals are absent, but a

dorsal production of the upper nasal occupies the position of the prefrontal so that it is practically certain that a fusion has taken place. Most of this has been pointed out long ago, by me and by Amaral, in articles to which Taylor refers in his bibliography.

Anomalepis is unquestionably a valid genus, but the line Anomalepis-Helminthophis-Liotyphlops-Typhlops is so clear and so close (Amaral considers Liotyphlops synonymous with Helminthophis) that it would be fantastic to place it in a separate family from Helminthophis.

14. Skeletal characters of *Anomalepis aspinosus.* Dr. Barbour very kindly offered a specimen for staining and clearing, and Dr. Zangerl of Detroit University put MCZ 14785, from Perico, Peru, through the processes and sent it to me. It is the basis of the remarks to follow. Unfortunately the specimen was damaged. Dr. Zangerl writes me that "on Sunday," Nov. 5, 1939, "somebody broke into my room, apparently looked at the specimen and dropped it while it was under preparation." The body is broken into 20 sections, a good many ribs are dislocated, and possible pelvic rudiments are impossible of certain identification. Both lower jaws are broken just posterior to the coronoids, and the maxilla-palatine-pterygoid chains of both sides are outside the head and floating separately in the medium. Fortunately, in spite of what occurred, it is perfectly possible to make out a good many interesting points in the beautifully stained and cleared material. The intruder ruined the specimen as an example of the preparer's art, but did not ruin it as a scientific specimen.

Allusions will be made to the following papers on Typhlopidae and Leptotyphlopidae, which sum up all the previous information concerning the skeletal anatomy of these snakes and add much that is new:

Essex, 1927, Proc. Zool. Soc. London, p. 908–927, figs. 39–84. I preface my remarks by saying that the skeletal anatomy of the present specimen fully confirms all previous authors who have regarded Anomalepis as related to Typhlops. The figures were drawn with a camera lucida; all are much enlarged, but the degree is various.

Haas, 1930, Zool. Jahrb., Abt. Anat., **52**, p. 1–94. Brock, 1932, Anat. Anz., **73**, p. 199–204, figs. 1–3.

Mookerjee and Das, 1933, Proc. Zool. Soc. London, p. 283.

Mahendra, 1936, Proc. Indian Acad. Sci., **3**, No. 2, p. 128–142.

a. **Vertebrae.** The atlas is a partial ring of bone divided ventrally. In *Typhlops braminus* it is also divided dorsally (Mahendra, 1936).

The odontoid is a part of the axis and not (as in *T. braminus,* Mahendra, 1936) a separate bone.

Hypapophyses are present on the odontoid, on the centrum of the

axis, and on the centra of the next three vertebrae. They are absent from the rest of the vertebrae.

The more anterior vertebrae have a "subcentral foramen" (Mookerjee and Das, 1933) as reported for *T. braminus.* The posterior vertebrae lack the foramen. The vertebrae in general closely resemble those of *T. braminus* as figured by Mahendra.

The count of vertebrae is not precise as the specimen is in 20 pieces and some may be lost, and the minute caudals can scarcely be distinguished, but I count a total of 178: atlas, axis, 168 with articulated ribs, 3 with forked transverse processes, and about 5 terminal rings. In this specimen Taylor counted 338 scales from rostral to terminal plate. Thus the relation of scales to vertebrae is close to 2-1 (as in *T. braminus*) rather than 1-1 as in normal snakes.

b. **Ribs.** The third and successive vertebrae have ribs for at least 168 vertebrae. These ribs anteriorly have a concave capitulum and no tuberculum. Posteriorly they have in addition a small tuberculum and closely resemble Mahendra's figure 10 of *T. braminus.*

Posterior to the last movable ribs there are three vertebrae each of which has immovable forked lateral processes closely resembling those figured by Mahendra for *T. braminus* (1936, f. 11). While the interpretation of these structures is problematical (they have been observed hitherto only in *T. braminus* by Mahendra, who suggests they represent sacral ribs), it is interesting to find them in Anomalepis.

c. **Pelvic vestiges.** None were found in MCZ 14784 from Perico by Essex. I can neither affirm nor deny their existence in the present specimen. In *T. braminus* there is a single rod of bone about 1 mm. long on each side "just below the skin" (Mahendra, 1936). The pelvic girdle of Leptotyphlops (cf. Essex, 1927) is always more elaborate than that of Typhlops.

d. **Cranium.** The frontals are paired, as is normal in snakes. The parietals are fused, as is normal in snakes. They are paired (Haas, 1930) in *T. braminus* and in *T. richardii*, fused in *T. diardi, T. lumbricalis, T. bituberculatus, T. punctatus* and *T. dinga.*

The supraoccipital is single, as is normal in snakes, and is excluded by the exoccipitals from the foramen magnum.

The prootics are separate bones, as is normal in snakes.

From Haas (1930) and Mahendra (1936) it would seem that there is much variation in Typhlops in the back of the cranium. *T. diardi* has an arrangement precisely similar to that of Anomalepis. *T. braminus* differs in lacking a supraoccipital. In *T. lumbricalis, T. punctatus,* and *T. dinga* the supraoccipital is paired. In *T. bituberculatus* and *T.*

richardii the supraoccipital, both prootics, and both exoccipitals are fused into a single bone. These statements are all from literature, and the most reliable are those of Haas on *punctatus* from dissection and those of Mahendra on *braminus* from stained and cleared specimens.

There is no tabular (supratemporal), and no such bone has been reported in any Typhlops, whereas the only Leptotyphlops carefully examined (*nigricans*, Brock, 1932) had a small tabular.

The anterior cranial bones (prefrontals, nasals, premaxillae, prevomers, and septomaxillae) show no significant differences from those of Typhlops, and consequently differ very considerably from those of Leptotyphlops.

e. **Orbital bones.** In the present specimen there are two well developed bones in the orbital region. One extends forward over the eye, lateral to the frontal, with which it is in contact only posteriorly where it overlies a conspicuous lateral projection formed at the fronto-parietal suture. It extends, free of any contacts, considerably anterior to the fronto-prefrontal suture. Its anterior end is curved downward somewhat and the eye is ventral to its tip. This bone may be tentatively identified as the supraorbital of Varanid lizards (or with one or another of the one or more supraorbitals which appear as neomorphs in Reptilia and are confined to that class). In Varanus the supraorbital is loosely attached anteriorly to the area of the fronto-prefrontal suture and its posterior end is free. In Python and its allies a supraorbital bone excludes the frontal from the orbit, but it is in firm contact on three sides with other cranial bones and its only free edge is the orbital border. In Achrochordid snakes the frontal is similarly excluded from the orbit, by a bone which is said to be an anterior extension of the postorbital (or postfrontal), but as information is scanty a possibility of fusion exists.

The other orbital bone of Anomalepis has no contacts with any other bone, lying free under the skin. Its pointed anterior end lies ventral to the eye, whence it curves up and back over the posterior end of the supraorbital to end in a point lateral to the parietal. This bone may be tentatively identified with the posterior orbital bone of Varanid lizards, which is a fusion of the postorbital and the post-frontal (Camp 1923, Bull. Amer. Mus. Nat. Hist., **48**, p. 361). In Varanus it is firmly attached to the frontal and the parietal, but the splint-like anterior and posterior projections are very similar to those of the bone in Anomalepis. In most snakes the bone is attached as in Varanus, but has neither anterior nor posterior projections, and extends vertically downward to form the posterior border of the orbit.

Mahendra (1936) reports and figures orbital bones in the only Typhlops so far studied in the cleared and stained condition, *T. braminus.* His description and his figures leave much to be desired, but do not detract from the important information that they are present. It is entirely possible that these bones exist in other Typhlops (examined by dissection) but have been removed with the skin. It is very difficult to avoid removing the supraorbitals of *Varanus komodoensis* with the skin, and should be much more difficult with these small snakes. *T. punctatus* merits reinvestigation more than other Typhlops, as *punctatus* has the marked lateral projection of the frontal which affords support for the supraorbital in Anomalepis.

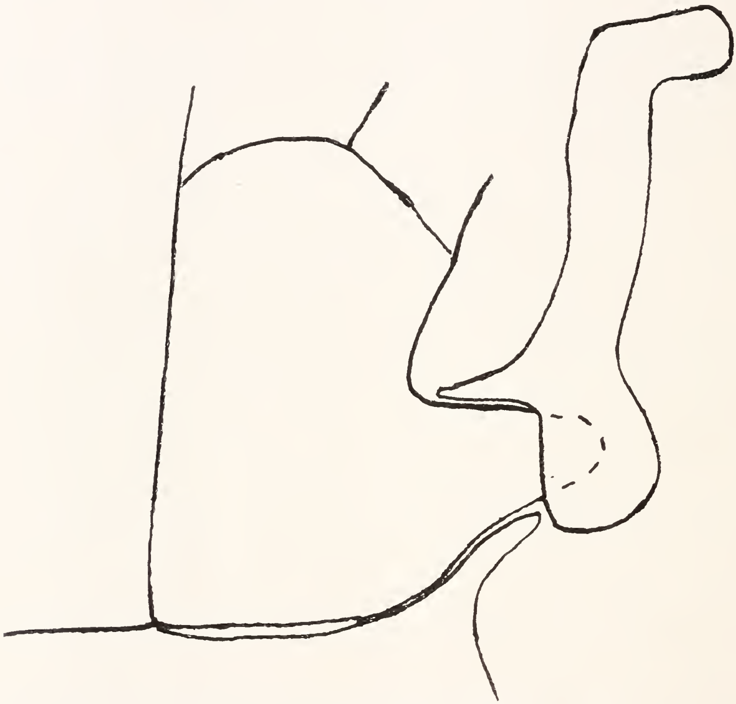

Fig. 1. Right frontal and supraorbital; portions of parietal, nasal and prefrontal also visible; right postorbital omitted.

In the cleared and stained material of *Leptotyphlops nigricans* studied by Brock (1932) there were no orbital bones.

f. **Upper jaw mechanisms.** There is a chain of three bones on each side, the anterior bearing teeth. These chains were outside the skull and completely detached from the rest of the specimen.

The posterior bone, the pterygoid, is a long rod-like structure, slightly curved at the anterior end. It is not dissimilar to that of *Typhlops punctatus* (Haas, 1930), except at the anterior end. Here the curved end overlaps the end of another bone extending still further forward, while in *punctatus* the end of the pterygoid is slightly forked to meet a bone extending crosswise.

The middle bone is slightly curved posteriorly where it overlaps the end of the pterygoid (the two bones curve across each other), and slightly blunted and forked anteriorly where it bears against the hind

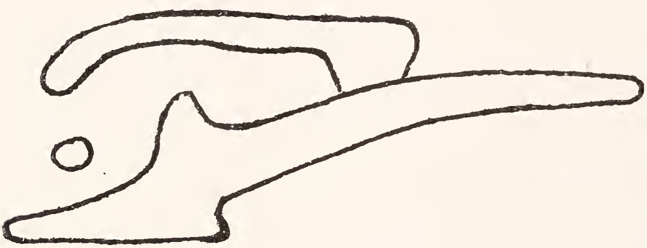

Fig. 2. Left supraorbital and postorbital; lateral view showing position of eye.

end of the maxilla. This bone is usually called the palatine, but it might equally well be the ectopterygoid. It is in contact posteriorly with the side of the pterygoid and anteriorly with the hind end of the maxilla, and this is precisely how the ectopterygoid of lizards and of normal snakes is oriented. The palatine in lizards and in normal snakes runs between the anterior end of the pterygoid and the side of the maxilla.

It has this relationship in Leptotyphlops. In Typhlops, while the mechanical relations are those of Anomalepis, the bone in question is in contact with the anterior end of the pterygoid. The form of this bone seems to vary a good deal in the different species of Typhlops. The view may be maintained, although I lay no stress on it, that the Leptotyphlopidae have lost the ectopterygoid and retained the palatine, while the Typhlopidae (including Anomalepis) have retained the ectopterygoid and lost the palatine.

The maxilla is a flattish, roughly triangular bone, quite like the maxilla of *Typhlops punctatus*, and, like it, bears five teeth. The end

in contact with the "palatine" bears the smallest of the five (the inner tooth, as the row is transversely oriented) whereas in *punctatus* the inner (morphologically hinder) tooth is the largest. The bone is obviously quite free from the premaxilla and the prefrontal. The maxilla of Leptotyphlops is neither flat nor triangular, is firmly united to premaxilla and to prefrontal, and is edentulous.

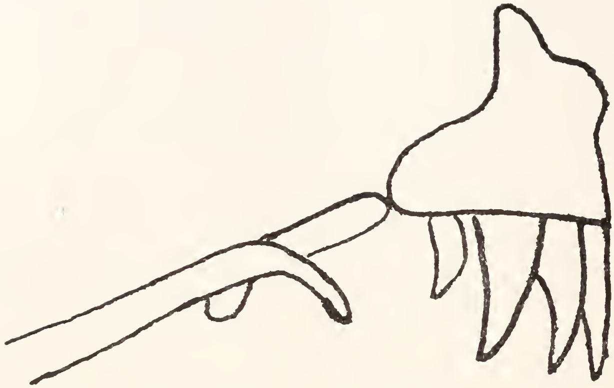

Fig. 3. Right maxilla, palatine and anterior part of pterygoid (entire pterygoid 4.5 times as long as alveolar border of maxilla).

g. **Lower jaw mechanism.** The quadrate in Anomalepis is a flat, irregularly triangular bone, less than half as long as the "compound bone" (articular, angular, prearticular and supraangular fused) of the lower jaw from its articulation with the quadrate to its anterior end, and shorter than the retroarticular process of this bone. The quadrate of Typhlops is similar to that of Anomalepis in shape and in relative size when compared to the "compound bone". The quadrate of Leptotyphlops is a long rod-like bone, as long or longer than the entire lower jaw.

The compound bone in Anomalepis is a long rod-like structure about four times as long as the coronoid-dentary part of the lower jaw. The compound bone of Typhlops is closely similar. In both genera there is a retroarticular process. This process is longer in Anomalepis than in any Typhlops yet figured. The compound bone of Leptotyphlops is only about as long as the coronoid-dentary part, and has no retroarticular process.

The coronoid-dentary part of the lower jaw in Anomalepis is quite similar to that of Typhlops, except that the coronoid lacks the acute

dorsal projection figured for Typhlops. As in Typhlops the whole lower jaw is anterior-posteriorly oriented. In Anomalepis the dentary may bear a single tooth at the tip. No tooth has yet been reported on the dentary of Typhlops.

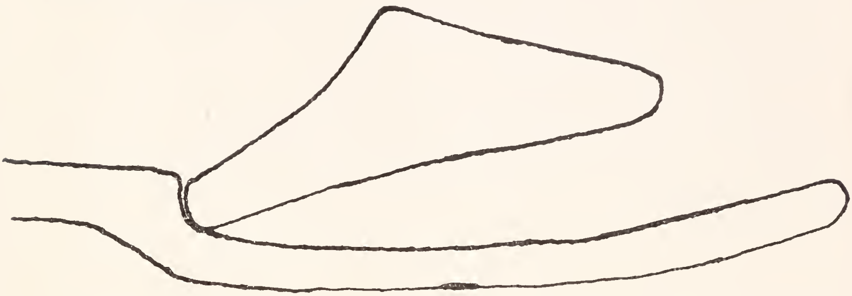

Fig. 4. Left quadrate, and posterior part of "compound bone," showing retroarticular process (the compound bone extends forward from the articulation 2 1/3 times the length of the quadrate).

The coronoid-dentary part of the lower jaw in Leptotyphlops is thick and short, like the compound bone in that genus. The dentary bears some five teeth. The whole lower jaw in Leptotyphlops is transversely oriented.

Fig. 5. Right dentary (showing the single tooth), coronoid, and angular.

h. This cursory account of the osteology of Anomalepis indicates an essential similarity to Typhlops and a profound difference from Leptotyphlops. The differences that exist between the skull of Anomalepis and that of Typhlops are neither great nor significant, and as the skulls of the two intermediate genera Helminthophis and Liotyphlops are entirely unknown, these differences are entirely insufficient to serve as a basis for more than generic distinction.

15. Summary.

a. I agree with Taylor in considering Peruvian and Panamanian Anomalepis as different forms. As the known characters of the Peruvian form are less similar to the reported characters of *mexicanus*, his action in naming the Peruvian form as new seems appropriate.

b. Taylor's action in naming the Panamanian form as new I consider premature and unnecessary.

c. Taylor's action in naming a new family Anomalepidae disregards entirely the obvious characters of scalation and dentition, disregards the obvious relationship of Anomalepis to Helminthophis, and is directly contradicted by the osteology.

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